INTERFACE AGE™

COMPUTING FOR HOME AND BUSINESS APPLICATIONS
VOLUME 4, ISSUE 1 JANUARY 1979 $2.00
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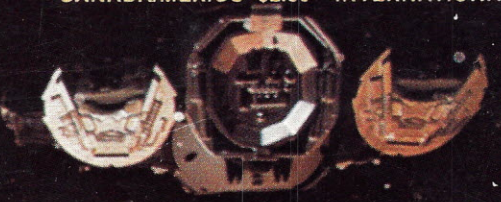

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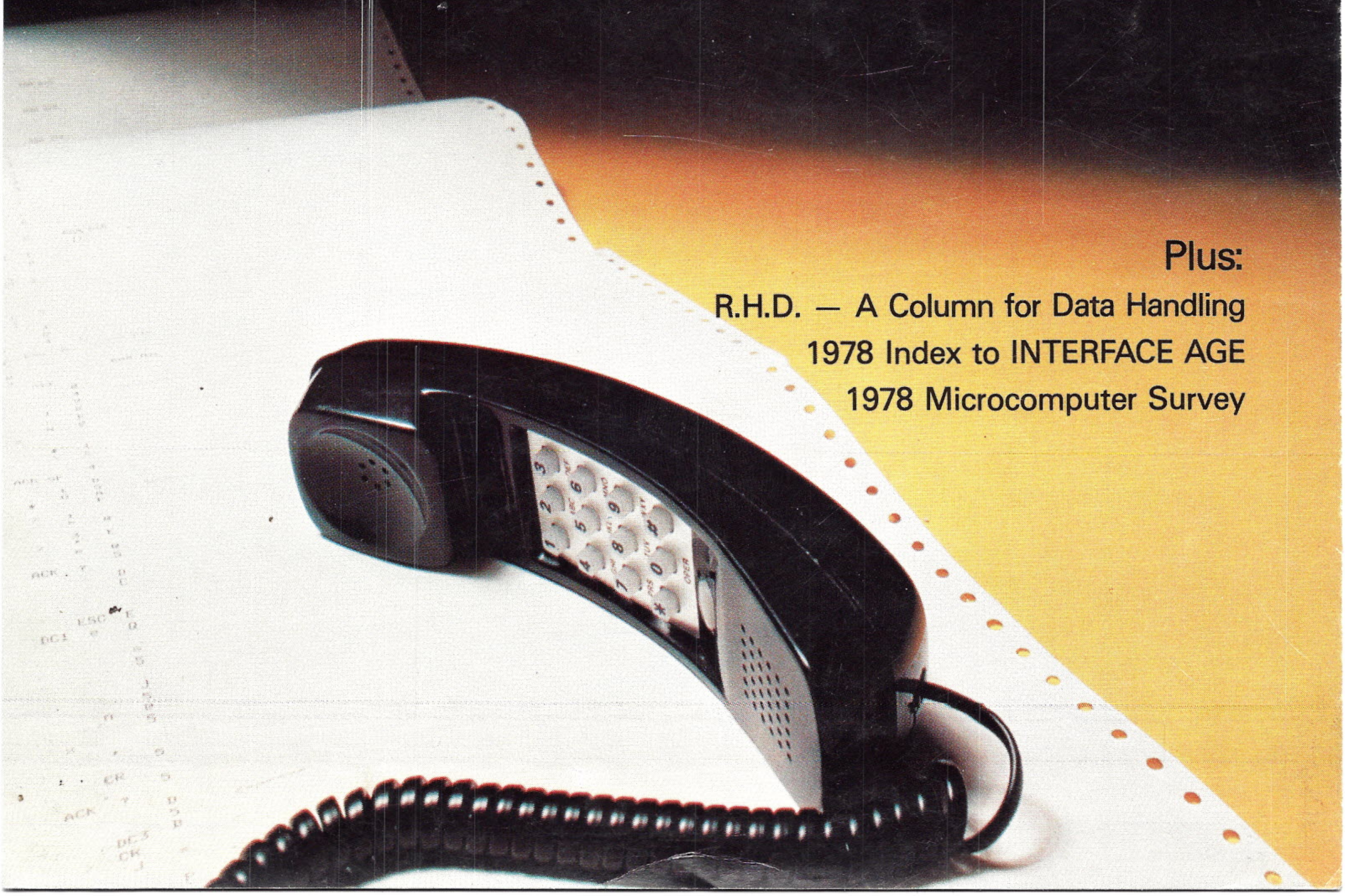
1978 Index to INTERFACE AGE

1978 Microcomputer Survey



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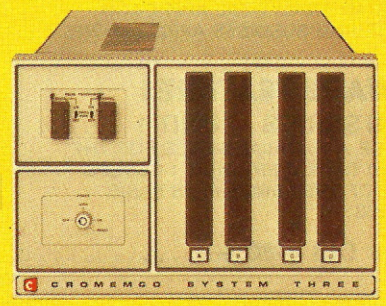

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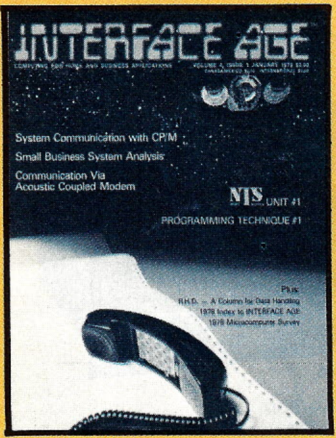
VOL. 4, ISSUE 1
SINCE DECEMBER 1975

JANUARY 1979

INTERFACE AGE™

COMPUTING FOR HOME AND BUSINESS APPLICATIONS



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1978 OPPONENTS & LETTERS

The past twelve months meant a great deal to me since it was my first year as the editor of probably the top magazine in the industry. This was an awesome responsibility in the beginning and tends to remain so as time goes on. However, I have found a great deal of solace by reading past issues of Popular Electronics and other electronic magazines.

I mention "PopTronics" because it was the first magazine to address itself to the microcomputer industry. But, more important, due to how long its been around, a feeling for what can and should happen with a readership is easily tracked.

An editor gets his impressions and readership contacts through letters. During the past year, I have received letters of praise and disgruntlement and, quite honestly, chose not to print a number of the complaint letters since they appeared to be written without any thought in mind. We did print a few, but primarily stuck with letters that offered other readers advice or needed an answer to a question. Ninety percent of the letters I receive are answered directly and are not published. After looking back on "PopTronics" and some other magazines, as mentioned, I found that I am apparently using the same tactics used by them for a number of years.

Art and the boys at PE had the same type of sparring partners that I have at IA. You see, there is always somebody out there who can do the job better. That's why you have it, and they don't.

My most tenacious opponent came from out of the East and presented himself in a letter that really had no foundation and was an attack on my ability to read. You see, it was felt that I paid a particular publication no attention, which, incidentally, it not true. I do make an effort to read every trade magazine and some club news every month. His feelings were hurt because I chose not to follow his thought processes and published another. As we used to say in the airline industry, tough rocks.

We do listen to many and try to read all. We make up our minds and present editorial material in the manner that we feel best suits the readership. Our concern is not with whether or not it is the same as some self-proclaimed guru's viewpoint. But enough said on this subject. This is a new year, and everybody starts at zero.

THE GOOD GUYS

Just about every month I get a phone call or letter asking me to rate the good guys and the bad guys. In past editorials, I have responded to this in several ways. In this issue we are publishing the results of our 1978 microcomputer survey which should help you decide who is on top and so forth.

But I am going to carry this just a step further. Bob Jones and myself receive a number of letters each month telling us how bad a company is and very rarely hear when something is done right. Adam Osborne receives essentially the same type of mail. However, there are three companies that we consistently hear praises about and, therefore, deserve a special mention to start the year off.

Bill Godbout Electronics has led the list in the amount of praise a company can receive. At least once a week, a letter or call comes in to tell me how good Bill treated them with a purchase or replacement. MECA, the tape drive people, rank about second on the praise list. Probably this is due to their relatively low-volume operation. However, Don, Nancy and Derryl have established a reputation of customer responsibility, reliability, and being just nice people.

The third company on the list, and this is not a ranking since we hear a lot about them particularly from the Southwest and Southeast parts of the U.S., is Southwest Technical Products. Dan and his group have really impressed a lot of people and most of them are a vocal lot.

Therefore, to these three companies and all the others that are doing excellent work, an INTERFACE AGE salute.

1979 PLANS

For 79 we have some big plans for you as readers. From the NTS mini tutorial and Programming Technique, to providing answer columns in the form of R.H.D. — Real Handy Data.

We have some other surprises and plans in store, and each month will promise to be even more interesting. Throughout 79, we will be changing formats little by little, and will, by next January, have a format that meets the many needs expressed by you, our readers.

So, Happy New Year! We look forward to some grand issues and really want to hear from each and every one of you this year. carl

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CADO'S GEORGE RYAN IN REBUTTAL TO RODNAY ZAKS' ARTICLE

Dear Editor:

I cannot restrain myself from responding to the editorial in your October issue. Mr. Rodnay Zaks is simply uninformed and has done a great disservice to your magazine and its readers in the piece that he has prepared for you. His statements, "At this time, no complete business software facility exists for microcomputers!" and, "However, the crucial task of simultaneous file management and sequential activation of selected programs is, as yet, not implemented" are simply not true. CADO has been delivering complete microprocessor based systems for over two years. We will have shipped our 1,000th machine this month (October 1978) and are now booking orders at a rate of almost 2,000 per annum!

I am enclosing a brochure on our System 20 that describes software and applications that Mr. Zaks claims do not exist. I am also enclosing a brochure on our new multi-terminal, multi-tasking System 40/IV, which is even more powerful than our stand-alone system. It is an interrupt driven multi-tasking computer that performs comfortably against the likes of IBM's System 34!

George M. Ryan
Cado Systems Corporation
Torrance, CA

Mr. Ryan, as I explained in our phone conversation, the Business Editorial page is for viewpoints. Consequently a retraction of a viewpoint is impossible.

However, rebuttal is possible and we encourage it strongly. We also suggest that companies such as yours take advantage of the page and present your views. As a result of Mr. Zaks' article, many are planning to do so. We therefore extend an invitation to yours or any company servicing the business community to take advantage of the Business Editorial page. *carl*

SOME INTERESTING THOUGHTS

Dear Editor:

I look at the future of microcomputers a couple of years from now and I really get worried.

I can see it now — A massive upheaval in microcomputers. Everyone's buying one, the local computer stores are thriving, the manufacturers can't keep up with the demand, and software is pouring out of every city in the land.

And THEN, it happens! The dust settles one day and the computer stores are empty (except for a few kids playing games). The people don't come back, and those small electronic marvels are either on the trash heap or given to the kids to play with. Everyone laughs when you say microcomputer, and you just don't understand. . .

And finally, it all comes to an end. On massive shelves we find row after row of unwanted microcomputers, right next to row after row of 40 channel CB radios, the nation's previous technology fad.

What happened? Where did it all go? WHAT WENT WRONG?

Almost everything, it seems. The consumer was sold a bill of goods. He was given a rose and was pricked by the thorns. Finally, the rose wilted and all he had left (or so he thought) were the thorns. He got fed up.

Hopefully, this will not come true, but the danger is disturbingly present in today's approach to microcomputers. Not in the equipment, not in the desire of those involved, but in the approach(es) being taken to put the computer into the hands of the small businessman.

Software and Systems will be the downfall! To understand what I mean, just look at what's beginning to happen.

The small businessman is being converged upon from two different directions, both of them foreign and alien to him. On one hand, the hobbyist-enthusiast is saying, "Now that I know programming, I'll make a profit doing the real stuff." On the other hand the mini-(maxi-) computer specialist says, "I know computer systems. I can make my background pay off, I'll scale down to this little computer and make a million."

And there is the problem. One is too new, too technical, too involved with the bits, bytes and soldering iron, and all that enthusiasm cannot guarantee good systems. The other one is too complex, too "big city," too ready with a big system answer to the little system need. Neither is close to the small businessman's turf, his territory. Both will try to fit

 CIRCLE INQUIRY NO. 58

"After working all day with the computer at work, it's a kick to get down to Basic at home. And one thing that makes it more fun is my Shugart minifloppy™. We use Shugart drives at work, so when I bought my own system I made sure it had a minifloppy drive.

"Why? Shugart invented the minifloppy. The guys who designed our system at work tell me that Shugart is the leader in floppy design and has more drives in use than any other manufacturer. If Shugart drives are reliable enough for hard-working business computers, they've got to be a good value for my home system.

"When I'm working on my programs late at night, I can't wait for cassette storage. My minifloppy gives me fast random access and data transfer. The little minidiskettes™ store plenty of data and file easily too.

"I made the right decision when I bought a system with the minifloppy. when you lay out your own hard-earned cash, you want reliability and performance. Do what I did. Get a system with the minifloppy."

If it isn't Shugart, it isn't minifloppy.

Shugart

435 Oakmead Parkway, Sunnyvale, California 94086

See opposite page for list of manufacturers featuring Shugart's minifloppy in their systems.

their solution to the problem, without understanding the uniqueness of the small businessman's needs and desires.

If the microcomputer is going to make it as big *as it should* in small business, we are going to have to understand the problem that we are dealing with. The small business is unique, highly demanding and constantly changing. Successful small business systems will be the ones that are able to address three critical factors:

1. The Nature of the Small Businessman.
2. Basic Human Engineering.
3. Reliability in System Design and Software.

A failure to adequately meet the requirements of any one of these areas could easily be the cause of complete failure. Let's look at each area briefly.

The Nature of the Small Businessman

The typical small businessman probably started by himself or with a partner, doing something that he really likes, such as dentistry, auto or motorcycle repair, selling parts, moving people, fixing plumbing, or whatever. He made good money and as the business grew, he added employees, new facilities and larger inventories. But somehow now he's no longer making the profit that he expected. Everything seems to be overly complicated and frustrating. No more fun, just lots of overhead, accounting, personnel problems, overstocks, understocks, and so on. What happened to doing the things he started the business to do?

If a computer is going to be able to help this businessman, it is going to have to *simplify* his life, not complicate it further. It will have to do enough to help him, without enslaving him to a machine. A solution that overwhelms the problem, and everything around it, is no solution at all. A well-engineered system should be able to relax the person using it and make him feel comfortable with it. It must be understandable to the businessman and not require a degree in computer science or electronics. Remember the axiom, "I'd rather have a problem I understood, than a solution I didn't."

Basic Human Engineering

A good system designer spends a lot of time trying to put himself "in the driver's seat." You have to understand the capabilities and limitations of the human who will operate the system (not as obvious as it appears). A computer system has to be helpful, convenient and maintain a *natural relationship* between what is done and what happens because of it.

An example may help. Everyone knows left, right, and back. Simple concepts. Yet, it would be quite possible to eliminate all lefts, and backs, and just use rights for all three: one right = right, two rights = back, three rights = left. Clever? One software routine instead of three. Well, it may be correct, but don't ask a real person to have to deal with it. Keep it simple and relevant — left, right, back.

Similarly, consider the car speedometer. The digital readout will never replace the dial and needle. A person can sense a straight up on the needle and know everything is fine. A number has to be interpreted, taking time and thought.

So, when systems are designed, the human has to be considered. People like to have things lined up and down, left to right, uncluttered, and NORMAL. They like things simple and easy, and they are willing to spend twice as much time on something that is simpler in order to avoid something more difficult. Thus, a system that has the operator learn HEX, count commas, or hit D for up and U for down will never succeed.

Reliability in System Design and Software

The businessman will not tolerate errors, not in something that he buys. All it will take is one day of rekeying yesterday's work, one bill for $1,000 too much, and he's back in after his refund. Again, consider the car. One unsolvable rattle, one stall at the wrong time, and it's a lemon, no qualifiers needed. There is no tolerance for lack of quality and that is going to be very true in computer systems also.

System developers are going to have to use the best techniques available to assure top quality software. Structured Design, Programming, and Testing, plus a host of other reliability techniques, will have to be religiously adhered to. No shortcuts, no gambles. The end-user, the businessman, will demand perfection, and he'll get it — or he'll reject the product completely.

In conclusion, we can easily see that the next major arena for the microcomputer will definitely be the small business. How this marketplace is approached will determine

success or failure. If the small businessman is met on his own ground with well-engineered, quality software and systems, he'll respond well and profit by it. If, however, he is presented with a ragged hodgepodge of thrown-together programs, or complexities beyond his comprehension, then the scenario I portrayed at the beginning of this letter will probably become a reality.

Larry D. Soderberg
VIS Group
San Luis Obispo, CA

Well said. I think all your counterparts will agree.

ANOTHER VIEWPOINT

Dear Editor:

The business editorial by Rodnay Zaks was timely and bluntly pertinent. It is especially important that Dr. Zaks' point concerning the requirement for single-entry capability rather than the currently available separate programs for payroll, general ledger and the like be emphasized over and over. Without the single-entry capability, the sellers of business system software are guilty of kidding themselves, and the public, when they advertise business system capability.

On the other hand, I believe that a salient point is being missed by the industry when they fail to recognize that with a micro a business can have a word processing system which should be comparable to the very best available, plus fairly substantial computational capability, plus — in the near future I hope — a reasonably adequate business system.

In our case, we have elected to go with the INFO 2000 system primarily because of the excellent reputation of the principals in a previous employment with one of the major minis. Although the software is distressingly behind schedule (when was it ever not?) the stress upon demonstrated performance still seems to be the best way to assure inherent reliability. May time prove us right.

Clinton H. Chamberlain, President
C. A. Chaney, Inc.
Box 49A, Route 2
Hayes, VA 23072

STILL ANOTHER VIEWPOINT

Dear Editor:

As a hobbyist who also has business use for his computer, I would take exception to the remarks of Mr. Edward L. Tottle. Microcomputers

It may be a hobby, or it may be an asset... It SHOULD be a Heathkit® Computer System

No matter what your computer system needs may be, Heathkit computers make sense! Heathkit "total design" computer systems give you a wide selection of peripherals, software programs to get you up and running fast; plus the reliability, service and responsibility that come from being a leader in the electronics industry for some 50 years!

OUR 8-BIT COMPUTER

Every Heathkit Computer Product is designed to offer substantial benefits over competitive products on the market. Our 8080A-based H8 for example, is more than just a simple 8-bit machine. With its "intelligent" front panel and keyboard entry and digital display, it actually lets you compute and program without the addition of any peripherals. It's an ideal computer training system, and when you're ready to advance, it's ready too. It's one of the most expandable computers around, and now with its NEW floppy disk system, it could be the only computer you'll ever need.

OUR 16-BIT COMPUTER

If you need the power, speed and versatility of a 16-bit machine, there's nothing better than our H11A. Based on the famous DEC LSI-11/2, the H11A provides complete DEC compatibility and access to the thousands of practical software programs and applications that entails. Along with our own complete systems software and our line of DEC-compatible peripherals including the DEC Writer II and our new floppy disk, you'll have state-of-the-art computing power at its very best!

OUR PERIPHERALS

The Heathkit Computer peripherals offer the same competitive advantages of our two computers. Our H9 CRT terminal, H10 paper tape reader/punch, ECP-3801 cassette storage recorder/player, and our new WH14 line printer, plus the new floppy disk storage systems all give you the quality, performance and value that Heath company is famous for. And we sell the memory, I/O interfaces and accessories you need to custom design a system to your particular specifications!

ALL THIS, PLUS HEATH DOCUMENTATION, SERVICE AND SUPPORT

One of the most important parts of ANY computer system is documentation. And Heath documentation is quite simply, the best around. If you buy our computer products in kit form, you get a comprehensive step-by-step assembly manual that takes you every step of the way from unpacking to final plug-in. The knowledge you gain in building your Heathkit computer is invaluable–for service if it's ever needed, for quick troubleshooting and correction, and just for understanding the workings of the machine. In both our kit and fully assembled products, our comprehensive operating and instruction manuals are fully detailed, thorough and accurate. This documentation, plus Heathkit technical consultants and service nationwide, make your Heathkit computer system one you can depend on–to work right the first time, and to last for years!

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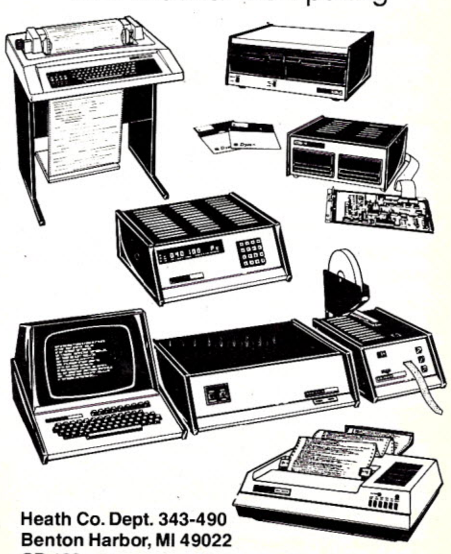


Heath Co. Dept. 343-490
Benton Harbor, MI 49022
CP-160

are not "hobbyist junk" nor are big-name minicomputers the epitome of reliable operation — there is a billboard in St. Louis, put up anonymously, which reads "Our IBM computer system is a lemon."

The watchword for buying a computer of any sort is "Investigate before you invest." There are companies — take Heath, for example — that are famous for good documentation. A friend of mind found that his Poly 88 wouldn't accept a new Dynabyte board and Dynabyte promptly modified his hardware so he could run their memory. "Good-guy" companies are to be found if you look for them.

As to maintenance, someone who *must* have the computer running at all times would buy only equipment from a local computer store that will provide a solid contract providing for a loaner while the busted hardware is being fixed. Failing that, how about Dr. Schenker's suggestion (INTERFACE AGE, August 1978) to have two systems to back each other up. With today's falling prices, it is not unreasonable. For example, it is possible to put together a 48K system with a Selectric printer, Z-80 CPU and four 5" floppies for slightly over $4,000. Hence, he who can't find a micro to do what he wants reliably hasn't tried very hard and a person who has his business shut down because of computer trouble should blame his poor buying judgement rather than the machinery.

Gary Martin
Kansas City, MO

You brought out some valid points and I hope everyone is listening.

AND ANOTHER ONE

Dear Editor:

I have never written a letter to any editor before, but after reading Mr. Tottle's letter published in your October, 1978 issue, I really feel the urge to sound off. I have read plenty of sour-grapes letters from dissatisfied micro owners who claim that micros are not suited for business applications, but I sit back and smile smugly. I own a PolyMorphic System 8813 and have been using it daily in my business now for over a year. I have never experienced any of the problems associated with other microcomputers.

My wife and I run a bookkeeping service bureau plus what may be the first microcomputer service bureau. We bought one of the first PolyMorphic System 8813 units released last year and immediately we started using the computer for our clients, running General Ledger. We now have Accounts Receivable, Accounts Payable, Payroll, Financial Analysis, Mailing List Maintenance, plus numerous others. PolyMorphic has released a word processor, inventory program, plus many others. Poly gives you elaborate documentation — both in the applications area as well as their system documentation manuals. I have never had a single problem with any of their software. We have had one hour of down time in a year. It was a blown printer fuse.

Servicing? Poly gives you a system "Confidence Testing" disk. You turn it on and it takes your system apart from nuts to bolts and prints out the results on your printer or screen. It is an exhaustive test. You can also get their Field Service Manual and a kit which includes such things as special ROMs which you plug in to test various items which the Confidence Disk detected.

Poly has continuously lived up to their obligation to update their system with modifications to hardware and software where necessary.

Yes, sir, this is not a hobbyist toy, it is a computer! You get what you pay for, Mr. Tottle.

Henry T. Keegan
Edgewater, MD

HAPPY WITH XEK

Dear Editor:

This is to express appreciation for this fine article ("A Text Editor for XEK and PTCO Assemblies, October 1978). I have used XEK with gratifying results for over one year. Recently I have found an unusual but needed section of application. This is to produce code for the HP97 programmable calculator. Working out lengthy programs on the calculator is a slow business. Being able to assemble source code and edit it rapidly is a great time saver. By making very small adaptations of the HP code, I can produce the source material rapidly. The minor modifications required are the use of a NOP after each label assignment and the need to use a plus sign for vacant spaces in the key codes.

I am reasonably certain that anyone doing much work with the HP97 would appreciate knowing of this application of XEK. Hopefully someone will come up with the actual assembler or even a compiler.

Robert Luckey, M.D.
Richland, WA 99352

Bob, you just might have caused someone to do it.

NEW CLUBS FORMED SERVICES EXPANDED

NEW CLUB FORMED DOWN UNDER

A newly formed Australian computer club, MICOM (Microcomputer Club of Melbourne) meets the third Saturday of each month at Railway Modelers' Hall, Will Street, Glen Iris. For more information write MICOM, P.O. Box 60, Cantebury, Victoria, 3126, phone (03) 277-1613.

POLY-88 USERS GROUP EXPANDS LIBRARY SERVICE

The Poly-88 Users Group announces expansion of services to PolyMorphic 8813/8810 disk system owners. Most of the current library of programs for the Poly-88 will be available on a similar basis as for the cassette versions.

Members may contribute a new program in exchange for their choice from the library or save the credit for a future choice. Members may also request programs for $2.50 each for handling and shipping on a disk that they furnish. Optionally, the Users Group will provide a blank disk for $3.

Membership fee is $5 (U.S., Canada and Mexico), $15 foreign for 12 issues of the Newsletter published every 2-4 months. Send membership dues, or $1 for the latest issue to:

Poly-88 Users Group
1477 Barrington #17
Los Angeles, CA 90025

TRS-80 CLUB FOR NORTHERN CALIFORNIANS

The "Redwood Empire TRS-80 Users' Group" is being organized in Sonoma, Marin, Lake, and Mendocino Counties. Anyone is welcome, whether they own a TRS-80 or not, small system or large.

Anyone interested can contact:

John Revelle
7136 Belita Avenue
Rohnert Park, CA 94928
(707) 528-1464

XITAN TDL INFORMATION EXCHANGE

A forum for the exchange of information among Xitan TDL users is being created by John Cameron. Cameron asks that interested users send in descriptions of any software or software desired. Also requested are system descriptions and applications and information about materials for sale.

Persons who want to receive copies of the information should send $3 along with their information to:

John R. Cameron
P.O. Box 1517
Palo Alto, CA 94301

INDUSTRY MEMO

A trade association is being created to support the growth and development of the Microcomputer Industry.

Named the Microcomputer Industry Trade Association (MITA), its membership is expected to encompass all segments of the industry including hardware manufacturers, software producers, retailers, systems houses, consultants, distributors, publishers and others.

The Association will bring all of these segments together to solve problems within the industry and to represent their interests to those outside the industry, according to Jim Warren, President of MITA.

"MITA will be involved in issues such as Microcomputer Shows, Interface Standards, warranty, service policies, retailer support, legislative action and consumer education, among other things," Warren said.

"These issues are the industry's major concerns and interests based on information gathered through public meetings and an informal survey conducted in the four months of the Association's formation," he explained.

He also stated that the Association expects to propose membership benefit programs such as group insurance, credit reporting, transportation discounts and others.

Warren is among eleven directors elected during an industry-wide meeting of approximately 140 at the Third West Coast Computer Faire November 3rd last year. Other formation meetings were held at major 1978 microcomputer shows during August in Philadelphia and September in Dallas.

The other directors are Carl Burlin, Byte Shop, Placentia; Jim Brown, Computer Data Systems; John French, Consultant; Bill Honeyman, Honeyman and Associates; Shelly Howard, Micro Computer Devices; Bill Langenes, Computer Retailing; Adam Osborne, Osborne & Associates; Neil Otto, Otto Electronics; Vern Raburn, GRT Corporation; and Don Smith, Jade Computer Products. Warren is publisher of Intelligent Machines Journal, Director of the Digicast Project and Chairman of the West Coast Fair. Langenes was elected secretary and Raburn treasurer.

The Board was elected on an interim basis until the next MITA general membership meeting to be held at the next major microcomputer show now scheduled for May 11-14 in San Francisco.

Prior to the meeting, the Board is establishing the Association organization, developing memberships, preparing objectives and programs and enlisting candidates for election to a permanent Board of Directors, according to Warren.

He said that companies indicating an interest in the Association were contacted during December last year and that a full membership drive is expected to begin early this year. Firms are being asked to make a $100 donation, applicable to membership dues when they are established. "My impression is that there is considerable interest in and support for an industry-wide Association both to solve current problems and to provide on-going benefits," said Warren.

Companies wishing to support MITA may send $100 as seed money applicable to membership dues when they are adopted at the May meeting. A check payable to MITA may be sent to Vern Raburn, MITA treasurer, care of GRT Corp., 1286 Lawrence Station Road, Sunnyvale, CA 94086. For more information contact Jim Warren, (415) 851-7075.□

This space is made available by INTERFACE AGE to provide information for and about the microcomputer industry.

INTERFACE AGE actively solicits comments or newsworthy items from those of you in the industry. Send your comments or news items to: Industry Memo, INTERFACE AGE Magzine, P.O. Box 1234, Cerritos, CA 90701.

HARDWARE/SOFTWARE/BOOK INDEX UPDATE

The October, November and December 1978 issues of INTERFACE AGE offered indexes to available hardware, software and books. The purpose of these indexes was to provide you, the reader, with as much information as we could obtain regarding the availability of products. Unfortunately, we missed a few companies, with the help of the U.S. Postal Service. As a result, we are providing this update to cover the companies that we missed.

HARDWARE

Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014
(800) 538-9696 or (408) 996-1010 Attn: Phil Roybal
Apple II high level color graphic computer system, Disk II storage system.

Gimix, Inc., 1337 West 37th Place, Chicago, IL 60609
(312) 927-5510 Attn: Richard Don
Complete 6800 system — Gimix Ghost plus complete SS-50 bus compatible boards and mainframe.

Micro Term Inc. (MTI), 1314 Hanley Ind. Ct., St. Louis, MO 63144
(314) 968-8151 Attn: Michael Marks
High quality, low cost low end user terminals: ACT I and IA, ACT IV and V and the new MIME terminal. They also offer a terminal designed for the deaf called C PHONE.

MPI, 2099 W. 220 South, Salt Lake City, UT 84119
(801) 973-6053 Attn: Ernest Campbell
Series 40 printers — 40 column dot matrix printers, designed as a commercial quality stand alone for the end user.

Southwest Technical Products (SWTPC), 219 W. Rhapsody
San Antonio, TX 78216 (512) 344-0241 Attn: Dan Meyer
Makers of 6800 based computer systems and accessories for the hobbyist and businessman. Recently introduced a low end intelligent terminal called the CT-82.

Thinker Toys, 1201 10th St., Berkeley, CA 94710
(415) 524-2101 Attn: Hilda Sendyk
Thinker Toys has a complete line of S-100 bus compatible boards: ECONORAM, SUPERAM 16K, SUPERAM 32K, and DISCUS I, an IBM compatible disk system. ECONORAM is a trademark of Godbout Electronics.

SOFTWARE

Interactive Microware Inc., 116 S. Pugh St., State College, PA
(814) 238-7711 Attn: Paul K. Warme
PRO TYPE wordprocessor for North Star disk systems and MECA tape systems. Plus DOS+, a high level DOS for North Star.

MicroPro International Corp., 5810 Commerce Blvd.,
Rohnert Park, CA 94928 (213) 224-1619 Attn: Chip Pood
SUPER-SORT, a high performance sort/merge and WORD-MASTER high level wordprocessor for dumb terminals.

MVT Microcomputer Systems Inc., 9241 Reseda Blvd., Suite 203
Northridge, CA 91324 (213) 349-9076 Attn: Don Picipovich
Multi-tasking DOS FAMOS™, MVT BASIC, Multiuser BASIC, ASM2 assembler for 8080 and Z-80, programmer selectable.

Structured Systems Group, 5208 Claremont Avenue
Oakland, CA 94618 Attn: Keith Parsons
Business software written in CBASIC for mid range and high end businesses. QSORT — sort/merge program, NAD — mailing list program, General Ledger, Accounts Receivable, Accounts Payable.

Southwest Technical Products Corp., 219 W. Rhapsody
San Antonio, TX 78216 (512) 344-0241 Attn: Dan Meyer
SWTPC provides 6800 systems software BASIC, disk operating systems and a 6800 version of PILOT.

BOOKS

Northern Technology Books, Box 62, Evanston, IL 60204
Four book series by W.J. Weller. Practical Microcomputer Programming: The Z-80; The Intel 8080; The M6800. An Editor/Assembler for 8080/8085 based computers.

If we missed you in this update, please let us know and we will include your product in the next update, as space permits. Send all information to: Hardware/Software/Book Update, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701. □

CORRECTIONS

The December 1978 issue had the following mistakes: The cover blurb DIABETICS AND THE TRS-80 should have read DIABETICS AND THE MICROCOMPUTER. This story is found on page 70 and is entitled *It's Not A Big Miracle* by Mathew Tekulsky, whose name was left off by the printers. The program is based around the Micropolis system and not the TRS-80, but it can be used on almost all disk based systems. For these errors, we apologize to Mr. Tekulsky, Mr. Faber and Micropolis. □

CIRCLE INQUIRY NO. 53

CIRCLE INQUIRY NO. 13

by other Apple owners. Our Software Bank is your link to Apple owners all over the world.

Alive with the sound of music.

Apple's exclusive built-in speaker delivers the added dimension of sound to your programs. Sound to compose electronic music. Sound to liven up games and educational programs. Sound, so that any program can "talk" back to you. That's an example of Apple's "people compatible" design. Another is its light, durable injection-molded case, so you can take Apple with you. And the professional quality, typewriter-style keyboard has n-key rollover, for fast, error-free operator interaction.

Apple is the proven computer.

Apple is a state-of-the-art single board computer, with advanced LSI design to keep component count to a minimum. That makes it more reliable. If glitches do occur, the fully socketed board and built-in diagnostics simplify troubleshooting. In fact, on our assembly line, we use Apples to test new Apples.

*Apple II plugs into any standard TV using an inexpensive modulator (not included).

**In California, call 408/996-1010.

Apple peripherals are smart peripherals.

Watch the far right column of this ad each month for the latest in our growing family of peripherals. We call them "intelligent interfaces." They're smart peripherals, so you can plug them in and run them from BASIC without having to develop custom software. No other personal computer comes close to Apple's expandability. In addition to the built-in video interface, cassette I/O, and four A/D inputs with two continuously variable game paddles, Apple has eight peripheral slots, three TTL inputs and four TTL outputs. Plus a powerful, state-of-the-art switching power supply that can drive all your Apple peripherals.

Available now.

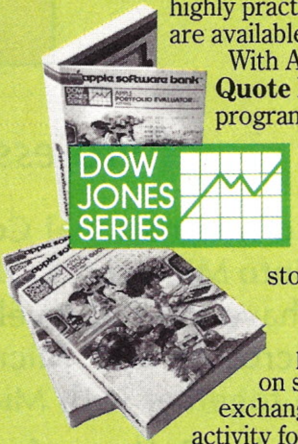
Apple is in stock and ready for delivery at a store near you. Call us for the dealer nearest you. Or, for more details and a copy of our "Consumer's Guide to Personal Computers," call 800/538-9696** or write Apple Computer, Inc., 10260 Bandley Drive, Cupertino, CA 95014.

apple computer®

New from Apple.

Valuable new series of software packages for investors

Now private investors can generate their own stock market reports and perform critical investment analysis instantly with Apple II. Just log your Apple II computer on to Dow Jones' central data bank with powerful Apple software: the Dow Jones Series. The first two of these highly practical programs are available now.



With Apple's **Stock Quote Reporter** program, a local telephone call links you to Dow Jones' continuously updated stock quotes for more than 6000 companies listed on six major U.S. exchanges. Current activity for stocks in the investors portfolio is delivered automatically: ask/open, bid/close, high, low and last prices, and volume traded.

Our **Portfolio Evaluator** enables you to analyze current value of your portfolio, and short- and long-term gain/loss for each stock—or for your entire portfolio.

Cost of Apple's Dow Jones service is a one time contract fee of $25, which includes the Stock Quote Reporter program. An additional $3 charge is made for the first three minutes of any transaction and 50¢ per minute thereafter.

To take advantage of Apple's new financial services, Apple II users need only a communications card, a modem and an ordinary telephone. This equipment, the Dow Jones Series, and a broad selection of other Apple software are now in stock at your local Apple dealer.

CIRCLE INQUIRY NO. 7

Programming is a snap! I'm halfway through Apple's BASIC manual and already I've programmed my own space wars game.

Those math programs I wrote last week–I just rewrote them using Apple's mini-assembler and got them to run a hundred times faster.

Apple's smart peripherals make expansion easy. Just plug 'em in and they're ready to run. I've already added two disks, a printer and the communications card.

MICROPRO INTERNATIONAL CORPORATION

MICROPRO

MICROPRO SUPER-SORT© → COBOL / FORTRAN / BASIC → COBOL/S / FORTRAN/S / BASIC/S *

"Professional Quality You Can Count On!"

*MicroPro International Corporation proudly announces the incorporation of SUPER-SORT© into Microsoft COBOL, FORTRAN and BASIC. Now, exclusively from MicroPro you can have the full level 2 COBOL sort verb implemented by joint cooperation between Microsoft and MicroPro. Enjoy the fastest, most flexible sort/merge/extract available together with Microsoft's compilers!

Other Quality Software from MicroPro:

WORD-MASTER© — Word processing on any CRT or VDM using CP/M** . $150.00
TEX** — Output Formatter .... $ 75.00
FINANCIAL ANALYZER© — ledger reporting on 99 profit centers;
has job cost accounting provisions and multiple checking accounts $250.00
with SUPER-SORT© $400.00
CORRESPONDER© — mail label program with letterwriting; multiple
sort fields, customer salutations; cheshire or single gum labels $95.00

**CP/M and TEX are Trademarks of Digital Research.

Prices and Specifications subject to change without notice.

Dealer Inquiries Invited: Call (Northern California) (707) 544-2865, (415) 398-7062, (209) 445-0511, (408) 279-8980, (916) 485-7619 (Southern California) (213) 224-1619, (714) 634-2908. Outside California Call Collect (707) 544-2865. Principal offices located at 5810 Commerce Blvd., Rohnert Park, CA 94928.

CIRCLE INQUIRY NO. 35

Clip and Mail This Form to MicroPro International Corporation at 5810 Commerce Blvd., Rohnert Park, CA 94928

Please Type or Print Clearly

ORDER FORM — Dealer Inquires Welcomed

Send To:

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______________________ company

______________________ address

______________________ city, state, zip code

Check Attached or Charge
Mastercharge #______________
Visa # ______________
Exp. Date______________
COD (10% deposit required) ☐

I agree to abide by MicroPro's End-User Agreement and either return the Software unopened or sign and return the End-User Agreement.

☐ COBOL $750.00 ☐ COBOL/S $800 ____
☐ FORTRAN $500 ☐ FORTRAN/S $550 ____
☐ BASIC $350 ☐ BASIC/S $400 ____
☐ SUPER-SORT© $250 ☐ Manual only $25 ____
☐ WORD-MASTER© $150 ☐ Manual only $25 ____
☐ TEX** $75 ☐ Manual only $15 ____
☐ CORRESPONDER© $95 ☐ Manual only $15 ____
☐ FINANCIAL ANALYSER© $250 ☐ Manual only $25 ____
☐ FINANCIAL ANALYSER©/SUPER SORT© $400
☐ Manual only $40 ____
TOTAL ____

____
Signature (if ordering diskettes or paying with credit card)

THE COLUMN

By Sandra Evans, Contributing Editor

Buying a computer for him seemed a good idea, at first. He was in love with it; the latest model he told you. It was such entertainment. The enthusiasm over this little machine amazed you. He appeared so creatively involved in something. New friends, which he quickly herded into the garage after brief, awkward introductions, were pleasant and they shared with him their enthusiasm in lengthy discussions and demonstrations. You even had time for yourself, appreciating a good book or an evening out with friends.

It was so nice seeing him enjoy his computer that the first signs of danger slipped past your awareness without even a flinch. The occasional meals he missed while working on new programs were noticed with slight disappointment, but the TV could always keep you company. When he did emerge from the garage, it was always with a "Gee, it's getting cold in there." But you never dreamed he would consider redecorating one of the rooms you so painfully "fixed up." You even snuggled lovingly back when he came with a hug, sighing, "Let's stay home tonight, honey. I'm kinda tired." Even though he did wander into the garage almost immediately, at least you had a quiet evening at home.

But eventually you did notice. It would have been difficult not to. It started one evening when you walked wearily into the house, exhausted but trying to smile when he shouted like a kid, "Close your eyes! I have a surprise for you!" That new dress, the chair you'd been wanting flashed through your mind as he confidently led you through the house assuring you you'd love it.

Had you not been so tired you might have made a firm stand then. But when you opened your eyes and saw that horrible metal desk with the grey-blue computer jammed into the lovely study you took so long decorating, you merely slumped into the nearest chair. "It's very nice dear," you said.

It was too late after that and things went rapidly downhill. If you weren't eating alone now because he was punching out a program, you were sitting alone because he was at the local computer shop. It seemed like the only time you heard his voice was when he was talking on the phone with his computer buddies, but you couldn't understand the language anyway. By the time he began coming to you explaining why he needed this new part or that new setup, things had gotten out of hand.

No end seemed in sight. Now he appeared to you like a mad scientist hunched over his experiments, muttering to himself. Equip him with black framed glasses, white socks and a lab coat and he looked like a Jerry Lewis character. The thought made you shudder as you remembered you had once vowed to spend the rest of your life with this man. In less bitter moments you dreamed of putting a TV guide on top of the computer and selling it at a garage sale, or painting it with measles and quarantining the study. In more desperate moments you wondered how to make bombs.

These dreams helped little, and you weren't sure what the next move should be until one day, while watching a local talk show, you saw a famous Doctor of Psychology discussing the marital boredom which seemed to typify your situation. "Get involved with him," she said. "Do what he likes to do," she suggested. It seemed like an awful lot to ask, but then you were desperate.

It was difficult at first. The oversimplified directions he gave, his visible frustration when you didn't know his answers fast enough upset and irritated you. But determination pushed you on. A few nights studying while he was out, a good deal of concentration when he was explaining, and a real desire to keep your sanity drove you to an expertise in his computer field that he had to admire.

Now things are different. He consults you for advice, and together over dinner in the study you discuss relative computer matters. You don't even mind the study any more. After all, it gets cold in there. Wouldn't the den be more convenient?□

UPDATE

TANDEM EXTENDS NON-STOPPABILITY TO NETWORKS

Tandem Computers, Inc., originator of the NonStop™ System, will soon begin marketing Guardian/Expand, an operating system that extends the nonstop capabilities of its computers from single site systems to worldwide networks.

This system is an extension of Tandem's Guardian operating system. It can accommodate up to 255 geographically dispersed systems, or communication nodes, each with a maximum of 16 central processors, for a total of 4,080 processors, all operating in Tandem's fault-tolerant mode.

The company also announced another software development, ENFORM. It is a powerful but easy to use method for querying databases, allowing retrieval of data from multiple files which may be related in ways which were unanticipated during the database design.

In addition, ENFORM produces reports at a fraction of the programming cost and time of conventional languages (e.g., COBOL), and its reporting options allow sorting and summarizing of retrieved data as well as evaluation of built in or user defined functions.

Expand and ENFORM will be released in March, 1979. The price of Expand includes a license fee of $10,000 plus a microcode charge of $1,500 per processor.

ENFORM license fee will be $7,000 plus $1,500 microcode fee per processor.

SOFTWARE FROM O & A

Osborne & Associates is now offering its payroll with cost accounting, accounts payable, accounts receivable and general ledger software packages previously published in book form, on CP/M BASIC. The programs will be sold on floppy disk for $250 each.

Once the packages are purchased, the buyer is free to alter, copy, and resell the software with no royalty payments to Osborne & Associates. The only legal limitation is that the software cannot be re-published in human readable form.

TWO CLUB CHAPTERS FORMED

Two chapters of a California hobbyist computing club, McDonnel Douglas West Personal Computing Society, have been formed. Chapters for home computing enthusiasts who have just bought or are considering the purchase of a unit have begun in Huntington Beach and Long Beach.

The monthly meetings are open to both employees and non-employees. Dues for the Huntington Beach chapter are $3 per year, plus $3 for the newsletter. For more information, contact Irwin Kanode at (714) 896-3663 in Huntington Beach or Steve Bayer at (213) 593-6303 in Long Beach.

CLUB CHANGES NAME

The Atlanta Area Microcomputer Hobbyist Club has voted to change its name to the Atlanta Computer Society. Meetings are held the last Wednesday of each month at 7:30 P.M. in the Community Room of Decatur Federal Savings and Loan Association, Dunwoody Branch, 1630 Mount Vernon Road, Dunwoody, GA. Visitors are welcome. For more information write ACS, P.O. Box 88771, Atlanta, GA 30338.

MICRO-DELCON 79

The Computer Society Chapter of the Delaware Bay Section of IEEE has set March 20 as the date of the second Micro-Delcon conference.

The meeting will be held in John M. Clayton Hall on the University of Delaware. The conference will provide a forum for exchanging ideas for local computerists. Contributed and specially invited papers on computer technology and application will be presented.

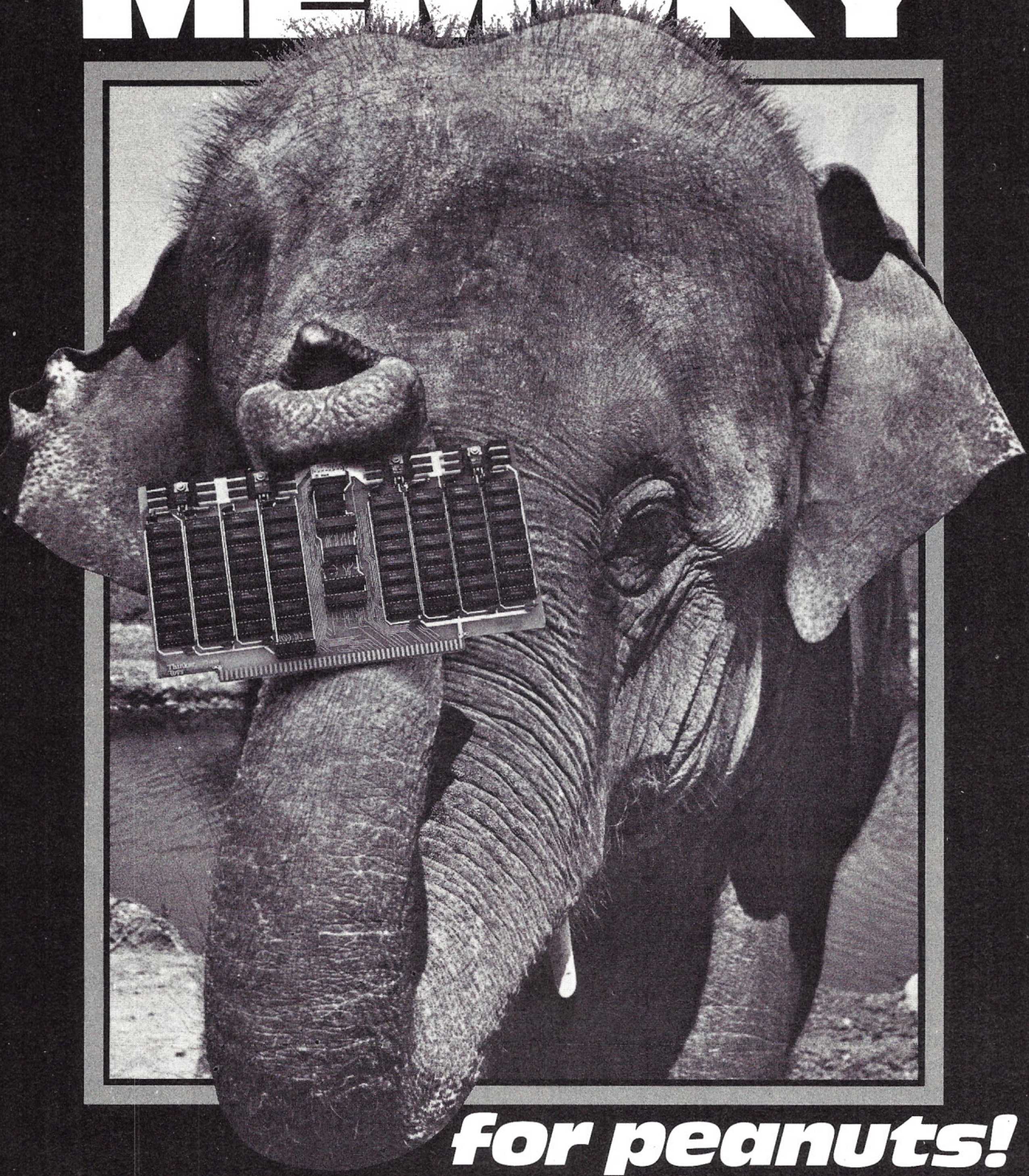
COMMUNICATION NETWORKS 79 CONFERENCE

The elite of the nation's voice and data communications leaders will headline the conference portion of "Communication Networks 79" at The Sheraton Park Hotel in Washington, D.C. on Jan. 30, 31 and Feb. 1.

Communication Networks conference will deal with many of the concepts and problems of the emerging network environment. Conference Chairman Richard Wiley will be keynote speaker. Also discussing trends will be Dr. Dixon Doll, well known data communications consultant; Prof. Anthony Oettinger, head of Harvard's program on Information Policy Resources; and Harvey Epstein, a Principal of Booz, Allen, & Hamilton and head of the consulting organization information manager practice.

Individual sessions will explore the revising of the Communications Act of 1934 and a town meeting on

ELEPHANT MEMORY



for peanuts!

CIRCLE INQUIRY NO. 52

At last, you can get a mammoth 32K memory without paying a beastly price. The SuperRam™ 32K **static** memory kit is just $649 for S-100 systems.

The latest of George Morrow's heavyweight memory designs for Thinker Toys™, the SuperRam™ 32K features two independent 16K blocks, each addressable and write-protectable. It meets the Proposed IEEE S-100 Standard with full buffering of both data and address lines. Uncommonly efficient, the Morrow design utilizes just 7 IC's for control and buffering, drawing typically 2.6 amps.

Ask your local computer shop to order the SuperRam™ 32K kit for you. Or, if unavailable locally, order direct from Thinker Toys™, 1201 10th St., Berkeley, CA 94710. Or call (415) 524-2101, weekdays 10-5 Pacific Time. Add $3 for handling. (Cal. res. add tax.)

Morrow makes memory for

Thinker Toys™

"Judy" the elephant courtesy Marine World—Africa USA

Regulation: Barrier to Network Profit and Growth. A key panel of "Futurists Field Day" will set out their own scenarios for network development in the 1980's.

For more detailed program news and registration information, call The Conference Company at (617) 964-4550, or write: Communication Networks, 60 Austin St., Newtonville, MA 02160.

CONFERENCE 2000

An omnidirectional conference telephone system is being offered by Northern Telecom, Inc. of Nashville. Its omnidirectional feature enables several participants to speak and hear within a 360 degree radius of the set. Conference 2000 can be used from as much as 10 feet away without microphones or auxiliary equipment.

The $2,000 system consists of a control module, the acoustic module with the omnidirectional microphone and six-inch long loudspeaker housed in a hexagon-shaped walnut acoustic chamber, the acoustic connecting cord, power transformer and earphone that enables a chairperson to hear all sides of a conversation including attempted interruptions from other locations.

The unit will be sold directly and through independent telephone companies, distributors and office supply outlets. The system is compatible with any standard telephone set.

WORCESTER POLYTECHNIC INSTITUTE TO SPONSOR SEMINARS

The Worcester Polytechnic Institute has scheduled three seminars to be held at a variety of dates and locations in Massachusetts.

"Microprocessors: Hardware, Software and Application" is for technical professionals who want an update on micro technology. The class will be held Feb. 22-23 and June 14-15 on the WPI campus in Worcester. Robert Solomon will lead the discussions.

Managers and supervisors who want to understand accounting concepts may want to attend "Fundamentals of Finance: The Management of Money" Jan. 8-9 on the WPI campus and March 26-27 at the Hotel Sonesta in Cambridge. An expanded session will be held June 4-7 in Cambridge.

"Improving Your Management Skills" will be held April 16-17 in Cambridge. Mel Silverman will head the program dealing with the manufacturing function's relationship to the rest of the company.

For registration information contact Ginny Bazarian, Office of Continuing Professional Education, Worcester Polytechnic Institute, Worcester, MA 01609; phone (617) 753-1411, Extension 517.

CALL FOR PARTICIPATION IN THE FOURTH WEST COAST COMPUTER FAIRE

WHERE: San Francisco Civic Auditorium and Brooks Hall

WHEN: The weekend of May 11, 12, 13, 1979

FOCUS: The fourth West Coast Computer Faire will focus on the use of inexpensive computers for home, education, business and industry.

Over 100 speakers are expected to present lectures and demonstrations of computers in all aspects of daily life. Some of the proposed topics are:

- Computer Assisted Instruction
- Electronic Mail
- Exotic Games
- Business Applications
- Telecommunications
- Hardware/Software Standards
- Languages
- Law
- Medicine

Everyone interested in participating in this lecture series should contact: The Fourth West Coast Computer Faire, Box 1579, Palo Alto, CA 94302, or call (415) 851-7075, and request a speaker's kit as soon as possible.

DEADLINE: Proposed talks and demonstrations must be submitted by March 1, 1979. **SO ACT NOW!**

SATELLITE TELECOMMUNICATIONS DELEGATION VISITS U.S.

A seven-person delegation from the People's Republic of China is touring the U.S. under the auspices of Electronic Industries Association's Communications Division. The delegation is interested primarily in satellite communications ground stations and related equipment. Two delegations representing members of of EIA's Communications Division visited China in 1975 and 1977.

Companies to be visited by the delegation include Scientific-Atlanta, California Microwave, GTE, ITT, RCA, Digital Equipment, Hewlett-Packard and Rockwell International.

Feb 1 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

Feb 1 Microcomputer Users Group (MCG) meets every Thursday at the University of Minnesota, Electrical Eng. Rm. 115 at 7 P.M. For more information write MCG, Dept. of Elec. Eng., 123 Church St. S.E., Minneapolis, MN 55455.

Feb 1 Northwest Computer Society meets in the Pacific Science Center in Seattle, Room 200 at 7:30 P.M. The club also meets on the third Thursday of the month. For more details write NCCN, Box 4193, Seattle, WA 98055.

Feb 1 The Connecticut Computer Club meets the first Thursday of each month at Suffield Library or Computer Store of Windsor Locks. For details contact Leo Taylor, 18 Ridge Court West, West Haven, CT 06516, (203) 933-5918 evenings.

Feb 2 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 P.M. Call Bob Latham at (504) 722-6321 for more details.

Feb 2 Microcomputer Information Group will meet at 7 P.M. at the Microcomputer Resource Center, 5150 Anton Dr., Rm. 212, Madison, WI 53719, (608) 274-8925.

Feb 3 Louisville Area Computer Club (LACE) will meet at the University of Louisville, Speed School Auditorium at 1 P.M. For details, write the club at 115 Edgemont Dr., New Alban, IN 47150.

Feb 3 Milwaukee Area Computer Club will meet at 1 P.M. at the Waukesha County Technical Institute, New Berlin, WI. Call (414) 246-6634 for further details.

Feb 3 Oklahoma Computer Club will be meeting at the Belle Aisle Library at 10 A.M. Call Al Campbell at (405) 842-4933 for details.

Feb 3 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. Call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629 for further details.

Feb 3 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. The club also meets on the 3rd Saturday of the month. For details contact SNPCS, 1405 Lucille St., Las Vegas, NV 89101, (702) 642-0212.

Feb 4 The Computer Hobbyist Group meets at 1 PM in the Green Center Rm 2.530, Univ. of Texas, Dallas. For details write P.O. Box 11344, Grand Prairie, TX 75051.

Feb 5 Amateur Radio Research and Development Corp. (AMRAD) meets at 8 P.M. at the Patrick Henry Branch Library, 101 Maple Ave. E, Vienna, VA. for details write the club at 1524 Springvale Ave., McLean, VA 22101.

Feb 5 Minnesota Computer Society meets at the Brown Institute, Rm 51, 3123 E. Lake St., Minneapolis, MN. For details contact the Society at Box 35317, Minneapolis, MN 55435, Attn: Jean Rice.

Feb 6 Tidewater Computer Club will meet at the Electronic Computer Programming Institute, Janaf Office Bldg., Janaf Shopping Center in Norfolk. The club also meets the 3rd Tuesday of the month. For details contact C. Dawson Yeomans, 677 Lord Dunmore Dr., Virginia Beach, VA 23462.

Feb 7 Columbus Computer Club meets at the Center of Science & Industry at 7:30 P.M. For more information write c/o Fred Hatfield K8VDU, Computer Data Systems, 1372 Grandview Ave., Columbus, OH 43212, or call (614) 488-3347.

Feb 7 Kitchener Waterloo Microcomputer Club will meet at the University of Waterloo, Room 3388, Engineering Bldg. #4, University Ave., Waterloo, Ontario, Canada at 7:30 P.M.

Feb 7 Lincoln Micro-Computer Club will meet at 611 No. 27th St. at 7 P.M. For details write Hubert Paulson, Jr., 422 Dale Dr., Lincoln, NE 68510.

Feb 7 New England Computer Society will meet in the cafeteria of the MITRE Corp., Route 62, Bedford, MA, at 7 P.M. Contact Dave Day at P.O. Box 198, Bedford, MA 01730, (603) 434-4239 for details.

Feb 7 The Valley Computer Club will meet at 7 P.M. at the Harvard School located at 3700 Coldwater Canyon, Studio City, CA.

Feb 7 Sacramento TRS-80 User's Group meets from 7-10 PM. For location and details call Sal Alestra at (916) 927-0237 or write 437 Berthoud St., Sacramento, CA 95838.

Feb 7 Great Gulf Coast Computer Club G^2C^3 in Mobile, Alabama, meets the 1st Wednesday of every odd month. For time and location of meeting call (205) 478-1777.

Feb 7 West Coast Computer Society meets at 8 PM, Rm 126 at B.C.I.T. in Burnaby, British Columbia. For details write the club at P.O. Box 4476, Vancouver, B.C., Canada V6B 3Z8.

Feb 8 Mid America Computer Hobbyist meets at 7 P.M. at Commercial Federal Savings & Loan, Bellevue, NE. (Galvin Rd. & U.S. Hwy. 73-75). Write P.O. Box 13303, Omaha, NE 68113 for details.

Feb 8 North Florida Computer Society will meet at 227 Edison Dr., Pensacola, FL 32505. For details write this address or call Eugene Rhodes at (904) 453-3844.

Feb 8 The Rochester Area Microcomputer Society will meet at the RIT Campus, Rm. 1030, Bldg. 9 at 7:30 P.M. For details write RAMS, P.O. Box D, Rochester, NY 14609.

Feb 8 Utah Computer Association will meet at Murray High School, Rm 154, 5440 S. State St., Salt Lake City, UT at 7 P.M. For details write or call Larry or Holly Barney, 1928 S. 2600 E., Salt Lake City, UT 84108. (801) 485-3476.

Feb 8 The New York Amateur Computer Club meets at Bernard Baruch College, Rm. 903, 17 Lexington Ave., New York, NY at 7 PM. For details write P.O. Box 106, Church St. Station, NY, NY 10007.

Feb 9 HAUCC will meet at 7:30 PM in Rm 117 of the Science & Research Bldg. of the main campus of the Univ. of Houston. For more details write or call P.O. Box 37201, Houston, TX 77036, (713) 661-6806.

Feb 9 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8, at 7 P.M. For details write NNJACC, 593 New York Ave., Lyndhurst, NJ 07071.

Feb 10 The Permian Basin Computer Group—Odessa Chapter meets at 1 PM, Electronic Technology Bldg., Rm 203, Odessa College campus. For details contact John Rabenaldt, Box 3912, Odessa, TX 79760, (915) 332-9151.

Feb 10 The Apple Corps meets at 2 PM at Greenhill School, 14255 Midway Rd., Dallas, TX 75240. For details write to this address or call (214) 661-1211, Ext. 34.

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Mr. Ken Tunnah, Colloid-A-Tron Inc., Buffalo, New York

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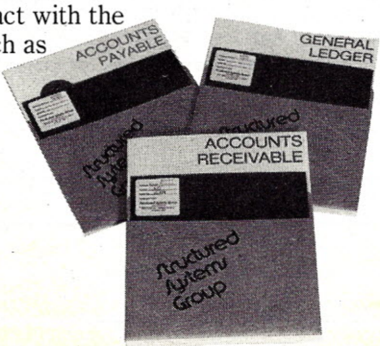

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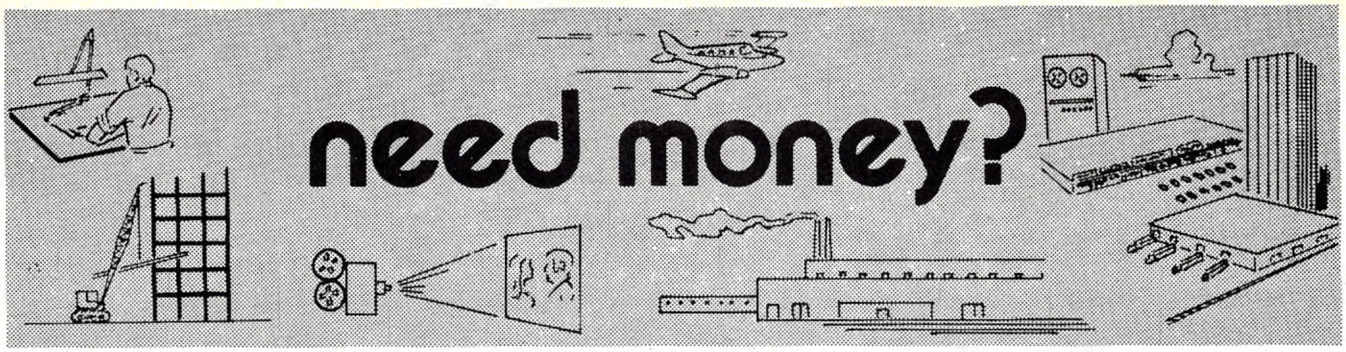

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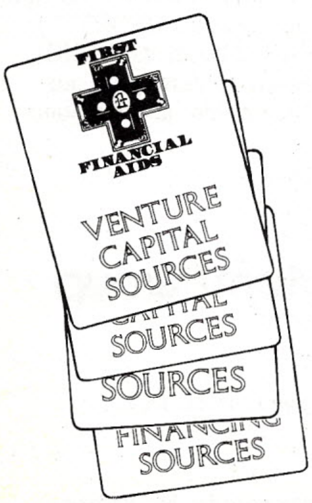

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Feb 11 North Orange County Computer Club meets at Chapman College, Orange, CA, at 12:00. 105 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-8080 eves. For details write P.O. Box 3603, Orange, CA 92655.

Feb 13 Okaloosa Computer Hobbyist Club will meet in the Community Room of the First Federal Savings & Loan Assoc. of Okaloosa County, 158 Elgin Pkwy N.E., Ft. Walton Beach, FL at 7 P.M. For details call (904) 242-5938.

Feb 13 Rome Area Computer Enthusiasts (RACE) meets on the second Tuesday of every month at Patty's Stagecoach Inn at 7:30 P.M. For details contact Mike Troutman, RD 1, W. Carter Rd., Rome, NY 13440, (315) 336-0986.

Feb 14 Home Computers Users Group for Radio Shack TRS-80 meets at 7:30 PM. For details write or call TRS-80 Users Group Information of Eastern Massachusetts, c/o Miller, 61 Lake Shore Road, Natick, MA 01760, (617) 653-6136.

Feb 14 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA at the Stanford Linear Accelerator Center Auditorium. Contact the club at P.O. Box 626, Mountain View, CA 94042, (415) 967-6754 for details.

Feb 14 Blackhawk Bit Burners Computer Club meets on the second Wednesday monthly at 7:15 PM in Rockford, IL. For more information contact Frank D. Dougherty, 325 Beacon Dr., Belvidere, IL 61008, (815) 544-5206.

Feb 15 Madison Computer Society will meet at 7:30 P.M. at 2707 McDivitt Rd., Madison, WI 53713. Mike Shoh, president.

Feb 15 Northwest Computer Society meets in the Pacific Science Center in Seattle, Room 200 at 7:30 P.M. The club also meets on the third Thursday of the month. For more details write NCCN, Box 4193, Seattle, WA 98055.

Feb 15 Sacramento Pet Workshop meets from 7-10 P.M. For more information contact David Howe, (916) 445-7926.

Feb 16 Amateur Computer Group of New Jersey (ACGNJ) meets at UCTI, 1776 Raritan Rd., Scotch Plains, NJ 07076 at 7 P.M. For further information write to the club at the above address.

Feb 16 Long Island Computer Association meets at 7 PM at the New York Institute of Technology, Old Westbury Campus, Route 25A, Rm. 508. For more details write Long Island Computer Association, 36 Irene Lane East, Plainview, NY 11803.

Feb 17 Computer Hobbyist Group of North Texas meets at UTA University Hall, Rm 108 at 1 PM in Arlington, TX. For details contact Neil Ferguson at P.O. Box 1344, Grand Prairie, TX 75051, (817) 387-0612.

Feb 17 Philadelphia Area Computer Society will meet at 2 PM at LaSalle College Science Bldg. at the corner of 20th & Olney Ave. For more details write PACS, P.O. Box 1954, Philadelphia, PA 19105.

Feb 17 The 7C's Committee (Affiliated with the Cleveland Digital Group) will meet at Cleveland

State University Student Services Bldg., in the Kiva Room at 2:00 P.M. For more information write to Cleveland Digital Group, 8700 Harvard Ave., Cleveland, OH 44105.

Feb 17 San Diego Computer Society will meet at the Grossmont Community College Student Center, 8800 Grossmont College Dr., El Cajon, CA. Doors open at 12:30. For details write P.O. Box 9988, San Diego, CA 92109, or call (714) 565-1738.

Feb 18 Central Florida Computer Club will meet at 2010 Fosgate Dr., Winter Park, FL 32789 2:00 PM. Contact Bill Kerns for details.

Feb 18 Cleveland Digital Group meets at 2 P.M. in the old railroad station at Safier's Inc., 8700 Harvard Ave., Cleveland, OH 44105. Write the club at this address for more information.

Feb 22 Space Coast Microcomputer Club will meet at 7:30 PM at the Merritt Island Library, Merritt Is., FL. Contact Glynn Mills at R3, Box 904, Merritt Is., FL 32952.

Feb 23 Alamo Computer Enthusiasts meet at 7:30 PM in Rm 208 at Naylor Technical Center, St. Philip's College, San Antonio, TX. For details call (512) 532-2340, or write to the club at 5411 Cerro Vista, San Antonio, TX 78233.

Feb 23 Washington Amateur Computer Society will meet at the Catholic University of America, St. Johns Hall, in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 A.M. and 12 P.M.

Feb 25 Birmingham Microprocessor Group will meet at Southcentral Bell Company headquarters bldg. at 2 P.M. For further details write or call Jim Anderson, 2931 Balmoral Rd., Birmingham, AL 35223; (205) 897-9630.

Feb 25 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Ft. Wayne, IN. For details write the club at P.O. Box 5096, Ft. Wayne, IN 46805.

Feb 27 The Digital Group Group meets the last Tuesday of each month in the meeting room of Consumer Systems at 2107 Swift Rd., Oak Brook, IL at 7:30 PM. For more information write the group c/o William L. Colsher, 4328 Nutmeg Ln., Apt. 111, Lisle, IL 60532.

Feb 27 The Apple Portland Program Library Exchange (APPLE) meets on the last Tuesday of each month at 7:30 PM. For location and details contact Ken Hoggatt, 9195 SW Elrose Ct., Tigard, OR 97223, (503) 639-5505 or (503) 644-0161, Ext. 6136.

Feb 28 The National Capitol Chapter of the Tandy Computer Users Group meets on the last Wednesday of each month. For details contact Rod Wright, 8205 Chivalry Rd., Annandale, VA 22003, (703) 560-5854.

Feb 28 Atlanta Computer Society will meet at 7:30 PM in the Community Meeting Rm at Decatur Federal Savgs. & Loan Assn.; 1630 Mt. Vernon Rd., Dunwoody, GA. For details write ACS, P.O. Box 88771, Atlanta, GA 30338.

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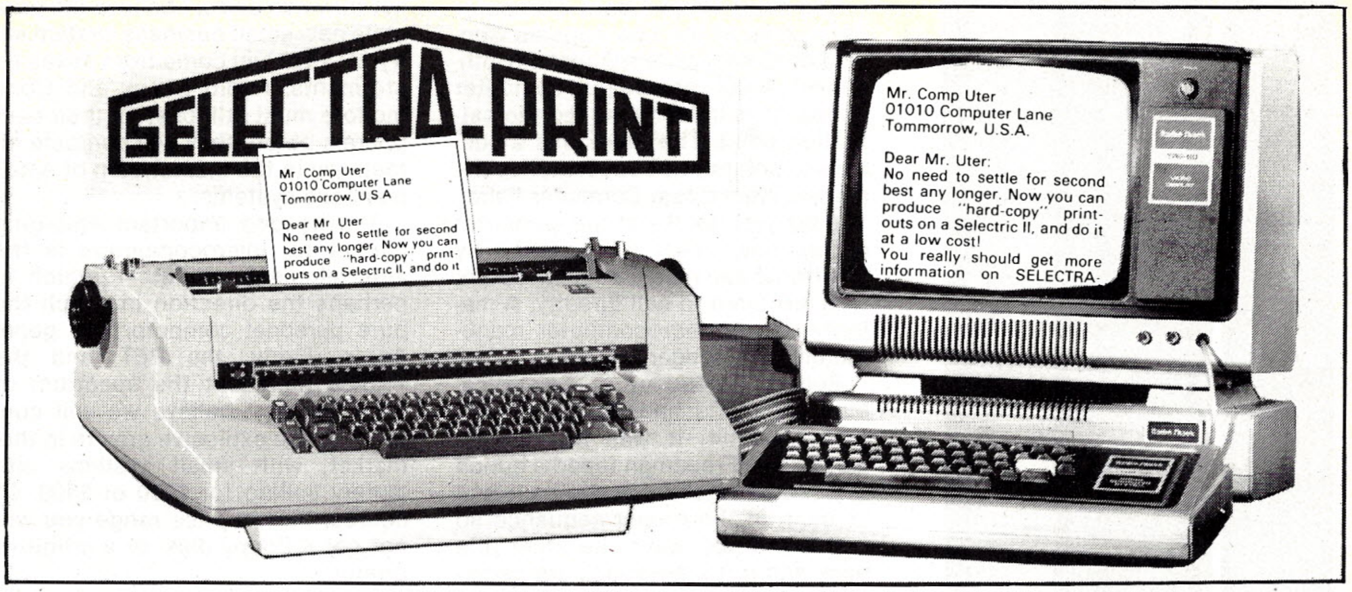

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"Innovators to the Microcomputer Industry"

FROM THE FOUNTAINHEAD

By Adam Osborne

The third West Coast Computer Faire, held at the Los Angeles Convention Center on November 4th, 5th, and 6th, finally proved that computer shows have indeed reached the saturation point. The Faire was a success (albeit not as successful as the second West Coast Computer Faire). The biggest booths at the computer shows now seem to be taken by electronic and hardware distributors who are there to sell directly. A majority of the microcomputer manufacturers no longer show up.

Robert Freedman of Lawrence, Massachusetts, had the most imaginative exhibit; it was his **"magic wand."** Mr. Freedman taped a bunch of LEDs to the end of a steel rule and lit them in the proper sequence so that when you wave the steel rule back and forth messages are generated out of the moving LED lights. There might be an interesting promotional gimmick in the idea. Anyone interested can call Mr. Freedman at (617) 683-4659.

The most important development to occur at the Computer Faire was the final formation of a **"Microcomputer Industry Trade Association"** (MITA for short). A temporary "ad hoc" board of directors was nominated for MITA; I am one of the board members. Jim Warren was elected chairman by the temporary board. For information regarding MITA, its aims, and how to join, contact Jim at (415) 851-7075. An organization such as MITA is badly needed. The microcomputer industry is now maturing and needs to be recognized as something more than a bunch of inexperienced amateurs and something different from the computer or semiconductor industries.

In a recent column I described the business software now available from **California Microcomputer Company.** Richard W. Smith, of the California Microcomputer Company, brought to my attention the fact that their programs are written in Opus — a stack-oriented BASIC from Administrative Systems Inc. of Denver, Colorado. I had erroneously described the programs as written to run under CP/M.

In 1979, I believe we will see three separate and distinct branches of the microcomputer industry emerging.

More than anything else, 1979 will be **the year of the small business system.** At least half, and perhaps more than half the computer stores in this country are already primarily small business system houses. I predict that more than 100,000 small business systems of the microcomputer variety will be sold during 1979. It is up to computer stores to see how large a portion of this market they can seize. I believe the principle new small business system entry for 1979 will come from Texas Instruments. Radio Shack and Commodore must still beef up their peripherals before they will compete effectively in the mainstream of small business systems.

The second important emerging market for microcomputers is the **entertainment market** — which is perhaps the direction in which the pure personal computer has gone. Apple, Exidy, the PET, and the TRS-80 represent the spectrum of this market. I believe we will continue to see explosive growth in this market, with small systems ultimately selling for $300 or $400. Of course, in this price range you will not get a floppy disk or a primitive printer.

It is going to take some dramatic new games to fire the imagination of buyers to the point where they will buy personal computers simply for game playing. Someone somewhere is going to produce that game which sweeps the nation and makes "Time" Magazine. That game (or games), when it appears, will do more than anything else to boost sales of microcomputers for entertainment.

The third and least understood segment of the personal computing market is the **hardware segment.** In terms of dollar volume, this is perhaps the smallest market. People in this market buy chips and build their own hardware. I believe this market is grossly overlooked because it represents such a small dollar volume for computer stores, and almost no volume for manufacturers. But in the long run, I believe this will be the most significant segment of the microcomputer market because it will bring more new and successful companies, and more important applications for microelectronics than any other area of the semiconductor industry. For the good of us all, I believe that the hardware enthusiasts who buy chips and wire-wrap boards should be given every encouragement, and a lot more exposure. Why don't you folks organize your own sessions at the computer shows and perhaps sponsor a few more columns in magazines? Our future may well ride on your endeavors.

There are some interesting **dealer developments** occurring. Where suppliers are weak, dealers have shown an interest in taking over the supplier. This is very healthy sentiment and one I would encourage. In particular, I suggest that the Byte Shops of the nation should take over the central Byte organization. □

RADIO SHACK GETS HELP

Bootstrap Enterprises of Richardson, Texas has been merged with HOW Distributors of Houston, Texas to form American Micro Products, Inc. This newly formed organization is one of the first to take advantage of the rapid end user build up of Radio Shack computers. As the President, William McNeil, explains Radio Shack to date has directed sales of their computer toward the business market. The TRS-80 is a powerful and versatile instrument that can be used in other applications. AMP plans to penetrate this expanding non-business market by:

1. providing a series of well engineered quality peripherals with maximum flexibility.
2. directing many of these products toward areas where the main frame manufacturer has little expertise.
3. making each of these specific interface devices highly portable.

NEW PRODUCTS FOR YOUR TRS-80

Most computer applications, be they business or scientific, require hard copy output. AMP has developed two line printer interfaces, the TRS-80 PM and the T Print Card, that operate without the Radio Shack Expansion Module. The first is a clever little module measuring approximately 4" x 2½" x ½" that plugs into the back of the TRS-80 and interfaces it directly to most popular printers requiring parallel input.

The second is a Vector 44 pin size card that provides the same capabilities of the Print Module but is designed to plug into a six slot mother board called the T Buss.

Each T Buss is supplied with one soldered on Elco connector with edge guides, PC board, and two feet of connecting cable with attached connector. Up to five additional Elco connectors (T CON) can be ordered and user installed. AMP offers the T Buss (A) with all six connectors factory soldered and tested for these people who do not wish to mount the remaining five on the mother board.

The T CRY and the T POW are two more options on the T Buss. The former is a fully buffered 2 MHz crystal oscillator that can be used for timing and control. The ladder is a power supply that produces 3 ampheres at $\pm$5 volts and 500 MA at $\pm$ 12 volts.

Once the TRS-80 user has this mother board he can selectively pick plug-in-boards designed to accommodate a wide variety of interface requirements. Serial IO, four part parallel IO, AC control, A to D, IEEE, EPROM, music and sound effects are some of the products AMP plans to offer as plug-in-cards for the T Buss. This buss structure serves as a vehicle by which American Micro Products can focus the power of the TRS-80 on applications such as process control, data acquisition, and entertainment.

As previously stated, manufacturing of unique and flexible TRS-80 peripheral products is the goal of AMP. What hasn't been stressed is the fact that they plan to make their plug-in cards highly portable. Should, for example Texas Instruments introduce a personal computer AMP would need only change the mother board and instantly most if not all of the current TRS-80 plug-in-boards would be compatible to the TI unit. This is a very powerful concept because it allows the end user to change CPU's while still salvaging the majority of his system.

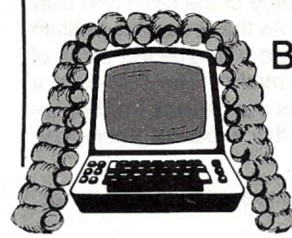
WHO IS BEHIND THE P.O. BOX NUMBER

American Micro Products, Inc. has three principal company officers, George Carlson, Bill McNeil and Gil Hartwell. Prior to heading up the engineering department at AMP, Carlson worked at Texas Instruments where he designed and built, among other things, the TI 59 calculator CROM emulator and the high speed 59 production card writer. Interesting enough both systems were built around Poly 88's.

Marketing and sales of AMP products are handled by Bill McNeil. He too hails from TI where he held such positions as District Sales Manager, Area Sales Manager and, for the last two years, Marketing Manager for Desk Top Programmable Calculators. McNeil's extensive sales and marketing experience coupled with the knowledge of application software compliments Carlson's engineering expertise.

The third member of the team, Gil Hartwell, is the successful owner and president of a multi-million dollar office equipment dealership in Houston. His presence brings American Micro Products the indepth business and entrepreneural knowledge few new companies receive. AMP will be located at 6550 Tarnef a few blocks from Hartwell's corporate headquarters.

JURISPRUDENT COMPUTERIST



By Elliott MacLennan
Attorney-at-Law
Stephen Murtha

PROFESSIONAL ADVISORS

This is the first of two columns which will deal with the topic of selecting professional advisors for your business. Regardless of how small a business is, it is important to consider the need for an attorney, accountant, banker, and insurance broker. Even if they are not needed immediately, they should be selected as soon as the business gets going so they are there when they are needed.

One of the most common mistakes made by the owners of small businesses is to fail to secure competent professional advisors or fail to use them once they are selected. The danger in not attending to these matters in the initial stages of setting up a business is that problems which do not surface until much later may go unnoticed by the entrepreneur. The nature of legal, accounting, banking, and insurance problems are such that often the symptoms of a problem are often manifested at a date much later than the date of the action which caused the problem.

This column will address the topics of how to select an attorney and accountant and what to expect from them in the way of services.

CHOOSING AN ATTORNEY

When choosing an attorney to represent any business, there are a couple of points to keep in mind. First, remember that the legal problems encountered by a business are usually very different than those encountered by individuals. It makes sense, therefore, to choose an attorney who specializes in business law. The attorney who did some friend's divorce is probably not the best person to choose, even though he is a heck of a nice guy and would love to do it.

The problem most often faced by entrepreneurs can be loosely grouped into two categories, legal and tax. Legal matters include such items as partnership agreements, incorporation, contracts, etc. Tax items will include such things as selecting depreciation, whether or not to incorporate, and the deductibility of expenses. An attorney will be able to offer advice on the legal matters by himself, but get the opinion of both your attorney and accountant about tax matters. An attorney should be willing to work with not only the company's accounting but all of the business's other professional advisors.

The best way to find an attorney who specializes in business and tax law is through referrals from other businessmen or businesswomen. If they have a company similar in size to the one being planned, and they are pleased with the work that has been done for them, then talk to the attorney who does the work. One should talk to several business owners to get as many names as possible.

the $988 Surprise . . .

If you haven't looked carefully at the Level-II 16K TRS-80, you're in for a big surprise! Level-II BASIC gives TRS-80 advanced features like comprehensive string handling, multi-dimension arrays, multi-letter variable names, named cassette files, full editing, integer arithmetic, single (6-digit) and double (16-digit) precision arithmetic, formatted printing, memory-mapped video (print directly at any of 1024 screen positions), 128x48 video graphics (may be intermixed with text), error trapping, auto line numbering, TRACE, PEEK and POKE . . . to name just a few. Because Level-II is in ROM, TRS-80 powers-up ready to go with the full 16K RAM available for your use.

This means TRS-80's memory is equivalent to a 28K RAM-based system.

New for 1979—TRS-80's numeric (calculator) keypad included on every 16K computer, and available as an add-on for present owners.

TRS-80's modular design allows easy expansion. Add up to 48K RAM, Expansion Interface, printers, 1 to 4 Mini-Disks, RS232C, telephone acoustic couplers, Voice Synthesizer, dual cassette recorders, our System Desk and Printer Stand. Surprisingly, these are not promises of things to come, but real products being delivered right now. Software from games to General Ledger are available, with more cassette and disk software being added monthly.

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CHOOSING AN ACCOUNTANT

Choosing an accountant to represent a business involves a number of considerations similar to those encountered in choosing an attorney. The first consideration is to learn all of the services an accountant should be expected to give, and to make sure that the accountant chosen will be able to provide them.

The services of an accountant are many, but there are four major ones that any accountant considered should provide. The first is that the accountant should be able to set up an accounting system for the organization that suits the needs of the company. In addition to maintaining a set of books, a good accounting system will be set up to gather information such as analysis of inventory, budget and working capital forecasts, and cost accounting data so company officers can make informed decisions regarding their financial progress and plans. A good accountant will be qualified to help set up this kind of system and tailor it to the needs of your specific business.

The second major area of service is taxes. An accountant should be able to offer advice on a wide range of tax matters, from choosing the proper depreciation method to looking at the tax implications of a lease/buy decision. The accountant should be willing to work with an attorney in the areas where their tax specialties overlap, such as the decision of whether or not to incorporate.

Audits are another speciality of the accountant. While a company may not need an audit during the initial stages of development, at some later date the organization may desire to take on additional investors or may be seeking a bank loan. In either case an audit may be required. It is best to have an accounting firm that can be trusted by everyone to perform the audit.

An accountant may be of service to the company when the organization is in the process of fund-raising. In addition to providing an audit, the accountant should be able to assist the company putting together any financial presentations, such as projected income statements or financial data which may be required by outside investors.

There are three types of accounting firms available to the entrepreneur. They are the Certified Public Accountant (CPA), the Public Accountant, and the Enrolled Agent. The major difference between them is the relative degree of qualification. Both the CPA and the Enrolled Agent are allowed to practice before the IRS. This is important if the accountant will do any tax work for the company. Unless an accounting firm is licensed to practice before the IRS, it cannot back up its tax work if the IRS takes issue with its viewpoint. The business will then have to secure outside help to contest the IRS decision. The difference between a CPA and an Enrolled Agent is that the CPA has passed the CPA exam in one or more states and has fulfilled the necessary experience requirement.

The next column will continue with a discussion of how to choose a banker and insurance broker. □

The material presented in this column is intended for the reader's general information. The authors request that the reader consult professional advisors prior to applying this material to his or her specific situation. Anyone seeking further information may contact the authors directly at:

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MICRO MEDICINE

By Wm. V. Weiss, M.D.
Professional Engineer

In the introductory column I briefly opened the discussion of "medical computing" by suggesting that medicine is in the process of discovering the computer. I must emphasize that there have been many successes and failures in this continuing love affair with "great computer expectations". A listing or description of all the previous (very monotonous) applications of medical data processing would be too long for anything instructive other than a potential prevention of the "reinvention of the wheel." Almost every other facet of health care, be it research, administration, clinical or educational, has been touched by information technology. Massive sums have been spent in the promise of some magical way of "getting something for nothing" and to the amazement of many, the returns have been quite modest in terms of a major impact on the way health care is delivered. It is necessary to examine this since the study of failure can be more productive than the study of success. Certainly from an editorial point of view both areas are interesting and deserve attention.

In stating that much has been done, I don't want to discourage inquiry. Part of the purpose of this forum is to encourage questions about past and current experiences in this vast field. I believe that the most interesting days of medical computing lie ahead. The current and developing technology allows considerably more versatility than previous larger systems on which much necessary experience was gained. I believe it is instructive to briefly review some of the reasons for previous failures as an excellent starting point in what I hope will be a lively dialogue.

Before I leave the impression that medical data processing has been unrewarding, I must stress some of the successes which have advanced, and continue to advance, the quality and delivery of health care. Progress in Hospital Bookkeeping has been an administrative tool of tremendous relevance, but as far as innovation is concerned, it really only represents a duplication of management techniques common to industry in general. Clinical Laboratory Automation has helped unsnarl the tangle of information pouring out of the analytical devices in laboratory medicine, i.e. biochemistry, bacteriology, and pathology test results. Again this is essentially a "process control" activity and is not so much an advance as just a parallel application of existing industrial data processing know-how. The patient rarely sees the direct benefits of these kinds of activities, but they definitely serve to control escalating costs by efficient use of existing hospital resources. Although I would not want to equate banking services or grocery store checking with hospital services, in general it appears that the use of data processing for logistical purposes could go a long way in the future towards insuring that patients are given attention in as rapid and individualized a way as humanly possible. At present the pa-

tient often feels like a client in the "wrong" line at the bank. The challenge is to develop systems that humanize rather than dehumanize health care.

C.A.T. Scanning represents a quantum jump in medical diagnostic testing. Computer Axial Tomography is a recent explosive development in the study of inner organs (brain, lung, liver, heart, bowel, etc.) which were previously hard to visualize by existing x-ray techniques. Here, astronomical numbers of computations result in organ pictures of spectacular precision and promise noninvasive diagnostic accuracy of high degree. This technology has an exciting future. Many doctors fear this could lead to "conveyor-belt" diagnosis without "the laying-on" of hands. Having observed such techniques in action, I would advise the pessimists not to hold their breath. Perhaps some day this will be possible, but for the foreseeable future I predict the incorporation of this new tool will be analogous to the days when the stethoscope first appeared. It will take massive clinical correlations (a very time-consuming process) before a sufficient fund of experience has been developed.

Other areas of considerable success in medical informatics include radiotherapy (cancer treatment dose calculations), electrocardiogram analysis, and intensive care (physiological) monitoring. Although these applications are novel to medicine, they truly represent only the transfer of existing technology (signal analysis, process control) to the medical arena. While these applications lack the romance of "automated diagnostics" and other artificial intelligence activities, they represent necessary steps in the learning curve of data processing experience in medical affairs.

Future success depends upon what will be necessary to create a climate for change. . .how to show the field it is really better off because of the computer system, and how to gain wide acceptance of a new system.

What are some of the impediments to a more universal application of information processing in health care? Perhaps an initial important observation is our expectation. I believe we expect too much too fast, a possible by-product of such success in other scientific areas. But remember, medicine is still more art than science in spite of media proclamations to the contrary. As such, art is very difficult to categorize and breakdown into components. This is not offered as an excuse but as a real fact which is often lost.

1. **We have yet to accomplish the patient-computer and/or physician-computer interaction.**

Remember that relatively inexpensive data processing is a very recent event and medical data processing is more than 20 years old. Recall that in medicine we deal with very special populations. The patient is frequently uncomfortable (in pain), anxious, depressed, or incapacitated, and the highly trained physician is often busy and with little time to learn how to operate a new device or change old written habits. In fact, recent surveys of medical computing installations indicate a very strong disinclination to terminal interaction on the part of even young physicians with computer experience. There can be no question that man-machine dialogue has been demonstrated, but how successfully remains to be

seen. To date it is clear that current terminal technology is less than ideal for doctor-machine or patient-machine dialogue of other than fairly modest kinds, i.e. well-motivated, reasonably alert patients or doctors.

2. **The physician has not been provided with computer-based medical applications that *exceed* his own capabilities.**

Most applications have been quite modest in scope. In other technical fields the computer performs prodigious computations and tasks previously incomprehensible to mankind. In health care applications, we have been satisfied to merely duplicate the physician. In mathematics, space physics, etc., the computer is regularly called on to carry out tasks that all mankind working 24 hours per day since creation could not begin to duplicate; but in medicine our measure of success has been the diagnostic accuracy of a skilled clinician, EKG analysis which is substantially correct, and historical data acquisition which saves a physician five minutes per patient. If our timidity were matched in other fields, it is unlikely anyone could have justified the expense or efforts. Perhaps the impact of computing in medicine has been disappointing due to our inability to see beyond the single physician and, thus, our inability to produce tools that do more than emulate the efforts of an individual physician. We have seen only "an automation of the status quo." Having developed programs to duplicate the physician, it is no surprise to find lack of interest in utilizing such developments. When researchers developed a technology capable of seeing inside the body, of measuring the heart's electrical activity, or developing a new antibiotic, there was great interest. No hesitancy about cost, justification, impersonal nature, or technicality.

3. **To date there has been little proof of medical computing's significant positive impact on patient care.**

No one could presently question the reliability or validity of information collected by computer-based interfaces. But we have not demonstrated that providers can make better or less costly decisions because of it. The cost-effectiveness of most systems has never been investigated or demonstrated. Often the problem may lie in the relative isolation with which computer researchers function. They have not often been part of an inter-disciplinary team and have little appreciation of those skills necessary to bring about change. In fact, research is rarely conducted in a fashion that is change oriented.

Future success depends upon what will be necessary to create a climate for change, how to involve users in a reexamination of the problem, how to show the field it is really better off because of the computer system, and how to gain wide acceptance of a new system. These limitations have resulted in the expenditure of large sums of money on projects which initially showed great promise for improved patient care but which in practice had little or no clinical impact. Is it unreasonable to expect resistance to change under these conditions?

4. **A major problem in reducing costly duplication of effort is the lack of transferability of programs from institution to institution.**

As in the current personal computing field, there is a wide array of languages and hardware configurations. In fact, there is probably more standardization in personal computing than there ever was in medical computing. An attempt at a universal medical-system language, "MUMPS" (Massachusetts General Hospital Utility

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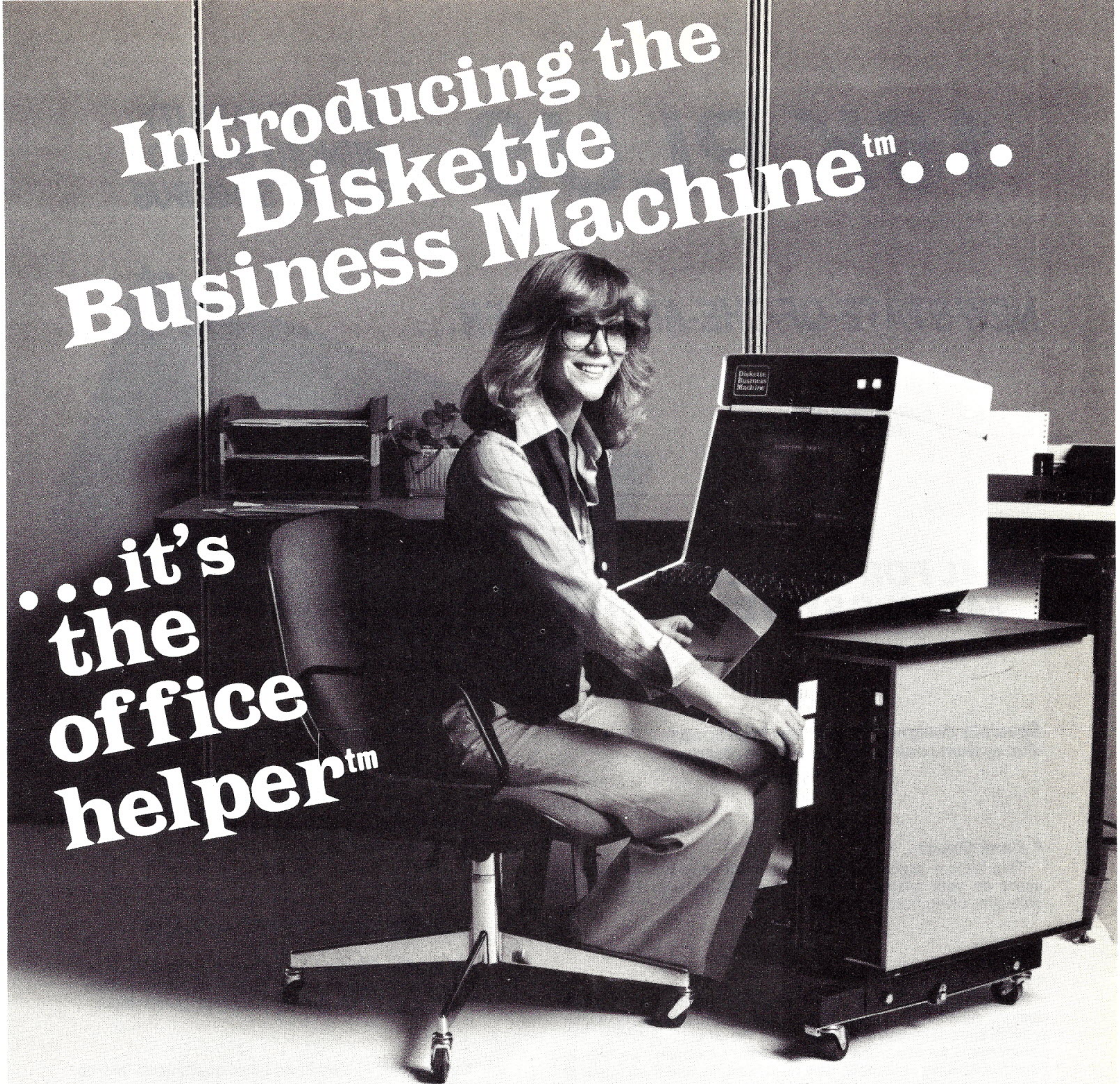

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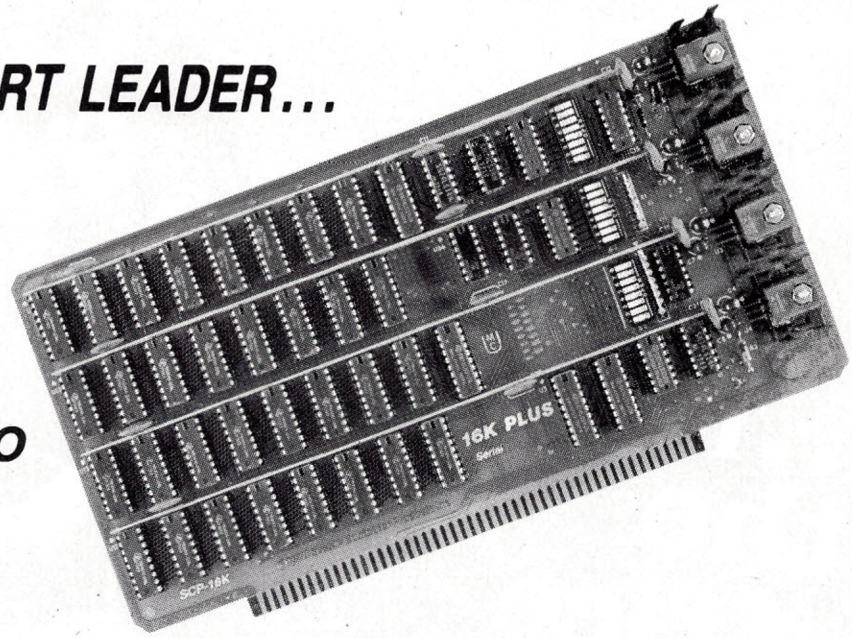

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Multi-programming System), has had only limited success and dissemination to date. This is not so much a language, as a database system language. One big problem has been an inability to use programs in other languages within this system language. There is, however, a fair number of users, and word has it MUMPS will soon be available for microprocessor systems. A lot of software is currently available. The type of material will be discussed in future columns.

Many projects have presently been oriented to the collection and storage of data rather than to improvement of medical decision making. Most successful innovations have resulted from careful problem definition and then collaboration between clinician and data processing professional. Computers cannot be used successfully in medicine as long as computer scientists function apart from the needs of the users. Ideally, the computer should not be used until it has been collectively determined to be the best tool to solve a problem at hand.

5. We have not learned from previous mistakes.

The application of new technology in the battle against disease has always been good copy, and the application of computers to health care is no exception. Perhaps the limelight and pressure to produce results has caused researchers to publish before adequate time had passed in individual efforts. The majority of projects today proved to be too costly or impractical. There have been too few follow up articles detailing the reasons for failures in spite of the fact that most researchers are quite willing to discuss these reasons. Perhaps this column can help serve such a purpose.

Lest I leave the reader with the feeling that this field has too many pitfalls to be of interest to general computer audiences, I must restate firmly my conviction that "the past is prologue" and that the real innovative medical computing is just about to begin. The key is to avoid working in a vacuum. It has been aptly stated elsewhere that the "gee-whiz" phase of medical data processing is hopefully completed. I believe we will now see a period of rapid growth of cost-effective and useful medical computing developments. Professional applications, whether for business or clinical purpose, should have well thought-out goals and expectations.

While I expect for some time that medical professionals will remain relatively naive by most computing professionals' standards, we can expect to see a rapidly developing awareness of basic standards as medical computing associations spread and disseminate warnings against the use of poorly supported and serviced systems.

In the next column we will examine an area of universal interest: the use of computers in patient medical history collection and analysis. No single application has received so much attention, has been subject to so much misunderstanding, and has consumed so many dollars. An examination of this subject can serve to show the very wide gap that sometimes separates the user from the data processing professional. □

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White Collar Microcomputer

By James S. White

This column is usually written for the small businessman who is just starting his or her involvement with computers. For such a person, the microcomputer can be a great tool.

The miercocomputer can fill another role well. For the more experienced computer user with a large workload, the microcomputer can be a powerful and cost-effective tool to enhance his traditional computer system. This month's column is written for such a user.

INTRODUCTION

Many presently installed Data Processing systems consist of a (non-distributed) concentration of computing and peripheral power, a tightly coupled system. Jobs are brought to this system to be processed. Physical transport of documents or cards, remote job entry, and time sharing are all common job communication techniques appropriate for the traditional computer system designed in accord with historical economic considerations, such as Grosch's Law.

The many advantages of a computer network formed by loose coupling of distributed processors have been widely publicized. Distributed processor network architecture has been adopted by many vendors as the basic design technique for new systems. However, many organizations presently using Data Processing systems have such an investment in hardware, software, and user training that they cannot economically benefit from new distributed computing technologies without major conversions. Another restriction preventing many organizations from using distributed computing is that many computer system vendors seem likely to initially offer these technologies only with larger computer systems.

A distributed computing system can be assembled by the EDP user. The following techniques are perhaps best suited to the medium scale user who has a moderate amount of in-house system development expertise, but are at least partly suited to a wide variety of other types of users.

REMOTE TERMINALS

For many users, the first step towards a distributed data processing system is the use of remote keyboard terminals. Whether video display or hard copy, whether used for retrieval, data entry, or interactive computing, these terminals bring the computer to the user. Such terminals allow the end user to make the computer an integral part of his daily routines.

Many commercially available terminals, especially those developed recently, are classified as intelligent. The intelligence in such terminals handles many functions which the terminal can perform better, and at lower cost, than the host computer. Intelligence also generally results in a higher level of service to, and of communication with, the end user.

Non-intelligent terminals linked to a microcomputer can produce the same benefits. Such a user-assembled terminal system consists of:

- A traditional central computer which maintains the data base and provides traditional peripherals, such as card reader and punch, high speed line printers, and large random-access data storage media.
- One or more user-programmed microcomputers which function as interfaces and as terminal and line controllers.
- Various personal terminals.

Such a system can have the following additional advantages:

- Terminals may be selected, from the increasingly wide variety of types and models available, to meet end users' specific needs. The user organization with the capability of interfacing with terminals from a variety of vendors can benefit much more than the user restricted to any one vendor's offering of a fraction of the many types of terminals that are and will be available.
- Increased terminal cost-effectiveness. The value of a terminal with features specifically selected from a wide variety is often greater than one chosen from the few available in a particular vendor's product line. Costs of user-selected terminals may be less, partly because of the elimination of unused features supplied (and paid for) in general purpose terminals.
- Terminal intelligence (specifically, the cost of the microcomputer supplying this intelligence) can be shared among several terminals, and per-unit cost thus reduced. Shared intelligence is appropriate where several terminals perform similar functions.
- The intelligence supplied for terminals can be that specifically applicable to the user organization.
- Microcomputers can handle more communication and data processing functions than intelligent terminals, thus decreasing the load on the central computer and effectively (and at low cost) increasing the total computing power available in the system.

COSTS

As one cost comparison, consider that general-purpose, intelligent terminals purchased from large computer system vendors often cost over $4,000. Non-intelligent terminals give equivalent or better results in most applications and can be purchased for about $1,000. Lease and maintenance prices of non-intelligent terminals are correspondingly lower than costs for intelligent terminals.

The key to practical use of non-intelligent terminals is the local microcomputer, particularly the type designed for communications. Although such units are available for $200, a versatile, comfortably powerful system can be purchased for under $2,000. This $2,000 microcomputer cost, added to the $1,500 terminal cost, results in a terminal system hardware cost well under the previously mentioned intelligent terminal cost. The normal approach of using one microcomputer to support several terminals substantially further reduces per-terminal costs.

Not only are custom terminal costs low compared to large computer system hardware alternatives, but the cost of a terminal is also quite low compared to the total investment most organizations make to support each employee and to the value of the productivity increases that can result from employee support. Cost benefits increase further as the decreasingly costly terminals become cost justified for an increasing number of applications, thus giving a broader base for allocation of central computer and standard software costs.

HARDWARE

Microcomputer and low cost minicomputer systems which support plug-in terminals and various communication modes and protocols are available now, literally off

the shelf, from many vendors. The variety of microcomputers, features and peripherals designed for network use is continually increasing. Also, many organizations are now using equipment which can be augmented and linked to form (peripheral parts of) a distributed network.

Although all system components a user might select are not usable as plugged in, due primarily to variances in communication techniques, use of the RS-232C "standard" allows choice from a variety of terminals with close to plug-in characteristics. Differences can be relatively easily reconciled by standard microcomputer hardware options and user modifications and software.

Most older computers have communication ports that use common protocols. Several types of microcomputers are so flexible they can practically conform, through software and hardware communication options, to the techniques best for the large computer.

SOFTWARE

Most presently available microcomputer software isn't oriented to terminal and communication control. Therefore, linking of assembly language modules and extensive use of large macros presently seem the most efficient user software development techniques.

The key to efficient software development is the design of standard modules that can be used on various network microcomputers with little or no change. When efficiency isn't of prime importance, the user can benefit from this total software flexibility by designing programs to precisely meet local needs. Evolutionary software changes may also be appropriate; one such approach is the replacement of large reports, used only for retrieval of selected data, by a video or hard copy terminal display of requested lines or paragraphs, formatted the same as the original report.

Programming of microcomputers can be done in several ways. Probably the most direct is use of a microcomputer of the same type as terminal controllers, augmented with peripherals to allow assembly and compilation of programs. One alternative is the use of a cross-compiler, perhaps on the host computer.

PERSONALIZED TERMINALS

The second step in the evolution to a distributed computing network can be the furnishing to user departments of more powerful, personalized terminal capabilities. (A department in this context is a group of computer-using personnel who share similar procedures, use similar data, and work in a small enough physical area that one multi-processor can control all departmental terminals.)

Personalization is accomplished primarily by software specialization, and by appropriate hardware augmentation. User benefits of this step are:

- Personalized input to the data processing system, as software controlling terminals allows shortcuts, generates constant data, and provides a high level of data validation. All procedures programmed are those which will optimize the performance of this small group of people.
- Personalized output, as software controlling terminals display only the data important to those users, and in sequences and formats consistent with their personal thought and work patterns.
- Personally experienced increased system performance in general, as the addition of local computing resources increases the computing power immediately and consistently available to that department.

The ultimate personalization is software specialized for each individual person or even several sets of software for the various jobs done by an individual. Ultimately, personalized software may use separate processors, or may share a departmental (multi)processor.

DEPARTMENTAL NODE HARDWARE

The EDP hardware supporting a department of the type previously described is a network node. A node consists of:

- One or more processors, the number and speed determined by the number of operations that must be performed simultaneously so that response to user service requests is sufficiently quick.
- Sufficient memory to handle all computing functions that are local to that node.
- Data storage peripherals sufficient to store the data used only by that node, and not by any other departments.
- User communication terminals.
- Communication links to other nodes, although the lines themselves are not usually considered part of the node.

Implementation of the departmental node concept can be a gradual, simple process. The normal first step is personalization of software, as various versions of the previously identical terminal controller programs are compiled and distributed to each microprocessor.

Hardware changes can be mostly transparent to end users. If one microcomputer has been controlling several terminals for diverse types of users, microcomputers may be added so different control software can be used for smaller, homogeneous-use groups of terminals. Other hardware changes, which can be done in small cost increments as the need arises, are the addition of memory, cassette tape or floppy disk drives for temporary data storage and the change or addition of user terminals.

DISTRIBUTED DATA BASE

The final step in the network evolution is the distribution of (parts of) the data base. This step is based on the fact that many types of data are retrieved and updated frequently by one department and infrequently by other departments.

Data which has a relatively high frequency of use by one department becomes a data base segment best maintained in that local node. Local maintenance can be less costly because of the simpler environment in which retrieval and processing occurs. Local storage generally improves user reponse time, particularly in that node, because of more direct communications and a more dedicated processor.

COMPUTATIONAL POWER INCREASES

Needs for increased computing power which become apparent during or after this step can often be met by judicious transfer of host computer jobs to a node microcomputer. Certain types of computing capability will be unused in a specific node or can be added to a microcomputer at much lower cost than to a large central computer. Jobs using such resources and requiring little data maintained in nodes other than the one processing the job can be transferred from the central computer. Often many such jobs can be transferred before the system reaches an optimally balanced condition.

Local data storage and maintenance requires additional hardware, generally in the form of disk drives. Large capacity drives are available as plug-in peripherals for microcomputers at significantly less cost than comparable drives used with most large computer systems. Newly available storage media types, such as bubble and CCD memory, promise to be cost-effective for many local data storage needs of microcomputers.

INTERNODAL COMMUNICATION

Distribution of the data base requires new techniques for access of distributed data from other system nodes. Internode communication can be handled, and initially probably should be, by continuing to use the central processor as a message switcher.

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Eventually, however, direct communication between nodes will become the most efficient method. The hardware to implement additional communication paths is available as low cost, plug-in options. Software, consisting of duplication of rather simple programs, is not unusually difficult for the average user.

The Hypercube provides a good model for communication in such a system. A classic Hypercube system is an array processor, consisting of various nodes; each node is a microcomputer with two processors (and generally costs less than $2,000). One processor handles only application programs; in our case these programs would be primarily for local terminal support and data acquisition from local data storage devices. The second processor handles supervisory tasks and especially communications with other nodes, including, in our case, the central processor. The processors communicate by direct-memory-access sharing of memory, a hardware optimized feature of certain microcomputers.

FUTURE POSSIBILITIES

The Hypercube approach provides a basis for further expansion of a data processing system because it is designed primarily as a technique for constructing a very powerful computing system as a loosely coupled network of microcomputers. Because jobs are not portioned and distributed, but rather are executed as various complete programs within each processor, supervisory system software remains simple. This approach is consistent with the majority of individual data processing jobs, which require no more memory capacity or central processor speed than is available in a microcomputer.

The user wishing to increase his total computing power could use this technique, without any increase in hardware in some cases. When required, costs of increased hardware and software may be considerably less than those required to accomplish the same result in a large, centralized system. Occasionally, some special techniques are required; these are neither supported by present commercially available software, nor are simple for the typical user to implement.

Ultimately, the original central computer may become only one of several powerful nodes, particularly if augmenting microcomputers has proven preferable to adding to the central system. If, at some time, continued use of the central computer becomes undesirable, it can be eliminated with little or no effect on the remainder of the network. This process can continue later, as unsatisfactory equipment is discontinued and replaced with little user effect.

LIMITATIONS TO APPROACH APPLICATION

A user-designed and built hardware system certainly isn't for everyone. A good analogy for explanation, and probably a decision guideline for an individual user, is the extent of use of vendor-supplied software. Some users make maximum use of vendor supplied packages with minimal modification. Generally, it is easier for these organizations to conform to the supplied package than to build their own. Most such users are probably best suited to hardware systems installed by one vendor.

Other organizations develop much of their own software, or make significant modifications to the vendor-supplied packages. Often such organizations find they cannot operate as efficiently using someone else's techniques as those that are precisely their own. For others, in-house software costs are less than the total costs of using vendor-supplied software. Many organizations which have the reason and capabilities to develop their own software will also benefit from assembling their own terminal and communication hardware system for data processing applications.☐

THE MIND REVOLUTION

By Merl Miller

In October, I briefly mentioned Ron Magazzu, who has written regarding some of the philosophies of cognitive learning. This is something we should all examine closely, so I will present Ron's views. What follows is the complete text of Ron's most recent letter, with parenthetical comments from me.

When you tell a child, "Don't go into the street or you will be killed," and he doesn't, then he has been programmed. However, when a child observes, experiences or understands (can form a mental picture of the consequences) the act of being hit by a moving vehicle, he learns. The learning (retention of information) occurs due to higher level, unobservable processes which take place; he knows *why* — not simply obeying a command.

The cognitive process is as follows: To be hit by a vehicle causes pain. "I don't want pain; therefore, I shall *remember* not to run into the street." Or, one step removed, "I don't want to break my Mommy's rules because it makes her mad; when she's mad she punishes me. Punishment is pain — I don't like pain." Also, these possibilities: To be dead is a loss of the chance to obtain pleasure. "I don't want to forfeit my pleasures; therefore, I shall not run into the street." Or this, "I love my Mommy and a loving Mommy brings pleasure. I love pleasure." The cognitive process that occurs could be any one of these — more likely, a combination of two or more. Whichever the case, each of the possibilities listed was acquired through learning, which began on the first day of life.

Based on the psychological assumptions that much (all?) of human behavior is motivated by a desire to achieve pleasure and/or avoid pain (masochists have learned to receive pleasure from pain), computers can't fall into the category of learning until manufacturers wire in pleasure and pain centers. (MKM: Or someone devises a machine that "thinks" on its own.) If these centers are wired in, in some fashion, you can see how complicated it would become when one must determine which center to stimulate for each instruction. Based on the *degree* of stimulation of either center, the computer must "decide" to learn (enter into memory) or not.

In humans, there are several pain and pleasure centers in the brain. These centers can be stimulated indirectly by external stimuli such as food, smell, a bright light, etc., or by internal stimuli in the form of thoughts. Many thoughts are recordings of external stimuli which were encountered sometime in the past. Human behavior tends to be repeated or avoided, depending on whether the behavior yields pleasure or pain. Often, the pleasure or pain which has been "attached" to a particular behavior becomes far removed through the process of association learning (far enough removed so that it is no longer apparent to the observer or even the individual himself). When we equate human and com-

puter learning, we are not aware of the association process. (MKM: Perhaps a machine will use a different approach.) An example of far-removed behavior is: A boy might get pleasure from going to *college* because it will get him a *job* which will earn him *money* which, in turn, will buy him *food*. It was the food itself that initially stimulated the hypothalamus; however, now this is achieved through associated factors — college, job, money.

The gray matter of the human brain is gray because these neurons are not insulated by myelin sheath, as are most of the neurons in the nervous system. This lack of insulation is a major factor in the ability to make associations (association learning). For example, you say to a child, "X." then say, "Y." and follow with giving the child some candy, he will eventually generate a "Y" in his mind on future trials when only presented with the "X." This is because the learned route to pleasure (candy) is X *and* Y. If you look at a cookie jar and begin to salivate you are experiencing the same phenomenon; that is, the original cause of the salivation was the smell and/or taste of the cookie. Now, salivation at the *sight* of the cookie jar demonstrates that the individual has learned that cookie jars contain *pleasurable* items. Prior to learning, the sight of a cookie jar will not cause salivation.

Man and machine can co-exist peacefully. . .If we want to expand the computer's ability to serve man, we should try to utilize its abilities rather than force our abilities on it.

This is the nitty-gritty of human learning, which is light years away for the computer's "mind." To achieve this kind of learning in computers would necessitate crossing its wires to allow association learning to take place. We all know that this is going to lead to bugs, bugs and more bugs. (MKM: This may lead to a different kind of learning that is unique to computers.) It seems to me, psychologist and programmer/analyst, that the computer "mind" was created to be flawless and reliable *at the cost* of its ability to learn as humans do; its wires are insulated. (MKM: That is why bugs wouldn't be a bad idea.)

In conclusion, I feel that humans and computers will work together and will not put each other out of business for a very, very long time.

A COUNTERPOINT

It is obvious that Ron has spent a great deal of time thinking about this dilemma. His comments are quite valid. However, I think he has fallen into an old trap. He is assuming that a machine must be humanlike to emulate a human. I disagree. One of the most significant steps forward in computer technology was the design of a computer independent of man — a machine that did not require man to be in the loop.

Man and machine can co-exist peacefully without either becoming like the other. A machine is capable of a very different kind of "thought." If we want to expand the computer's ability to serve man, we should try to utilize its abilities rather than force our abilities on it. The true purpose of the mind revolution should be to expand man's ability to use his mind. The computer can provide us with this capability. It is people like Ron who will make the computer a true, thinking servant of man. But let's not lose track of how this is possible. We have before us the greatest mechanical device ever invented. □

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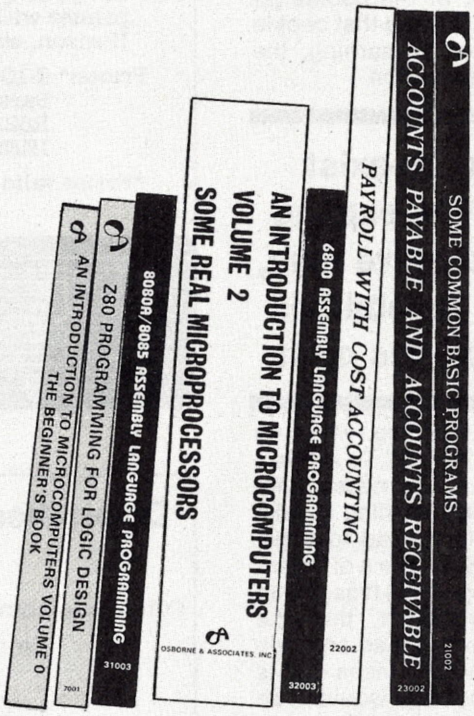

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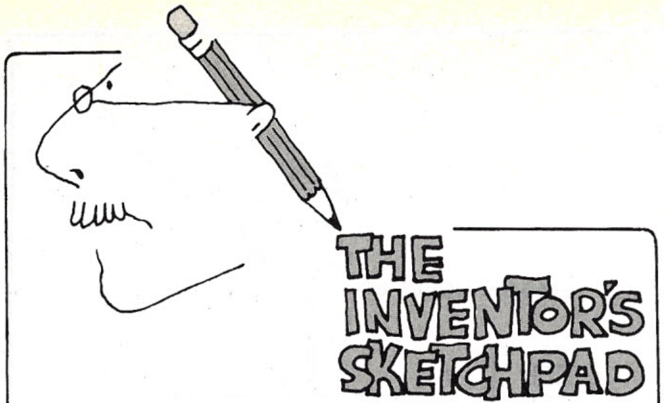

By Roger Garrett
Northeastern Regional Editor

DIRECT DIGITAL READOUT FROM DIALS AND SLIDE SWITCHES

One of the more recent integrated circuit developments to appear on the market is a DIP with a linear array of light sensors. Typically it will have 1024 light sensing elements, each element being individually addressable. The normal use for these devices is image processing, but this is an application that I suspect the designers of the device didn't have in mind.□

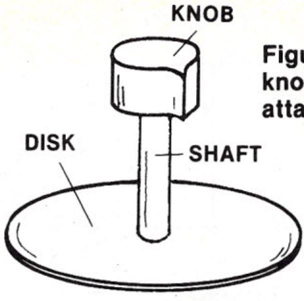

Figure 1. We start with a knob attached to a shaft attached to a disk.

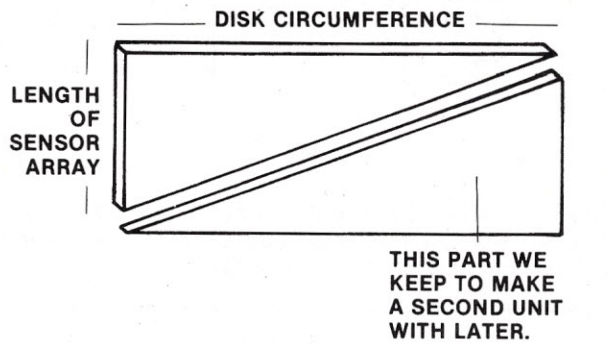

Figure 2. From a piece of suitable material (sheet metal will do nicely) we cut out a right triangle so that one adjacent edge's length is the same as the circumference of the disk and the other edge is the same length as the light sensor array in the DIP (we'll get to the DIP in a moment).

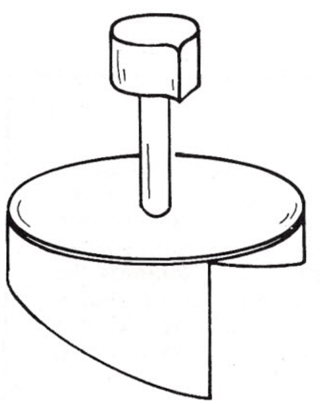

Figure 3. Then we bend the triangle around and attach it to the bottom side of the disk.

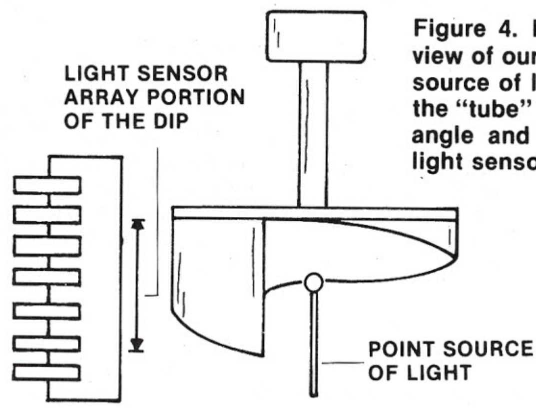

Figure 4. Now, looking at an edge view of our unit, we position a point source of light in the very center of the "tube" formed by the circular triangle and place the DIP with the light sensor array as shown.

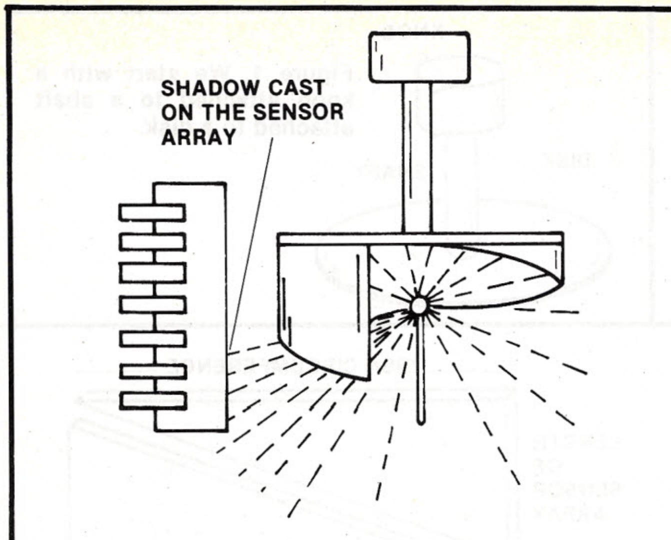

Figure 5. When we turn the light on, the section of the circular triangle that is between the light and the DIP casts a shadow on the light sensor array.

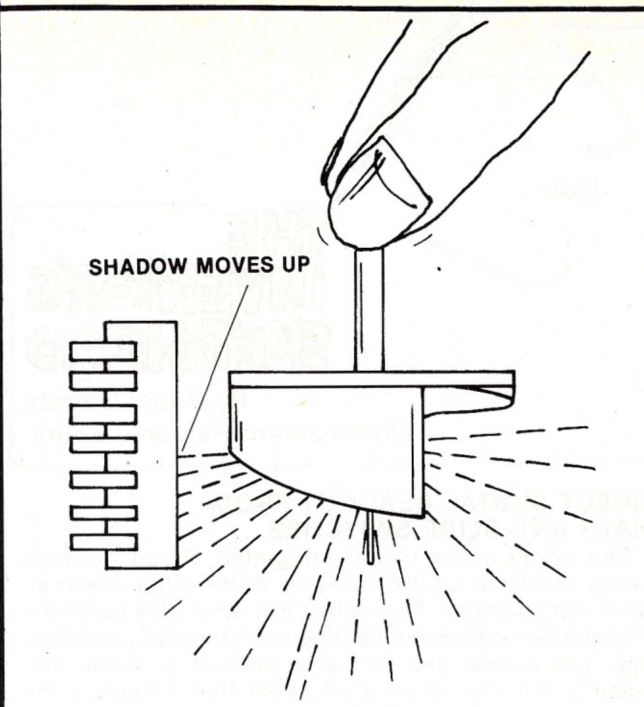

Figure 6. As we turn the dial the shadow line moves up...

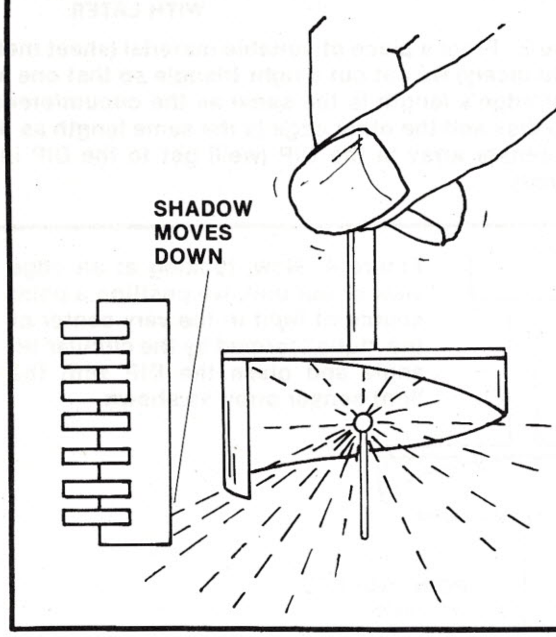

Figure 7. ...or the shadow line moves down, depending, quite obviously, on which way we turn it. Since the shadow line is directly related to the rotational position of the dial and, since with a fairly simple circuit we can determine which of the 1024 light sensor elements the shadow line touches, we can get a 10-bit parallel digital readout from the dial directly to the computer. All this with no analog-to-digital conversion (and its inherent slowness).

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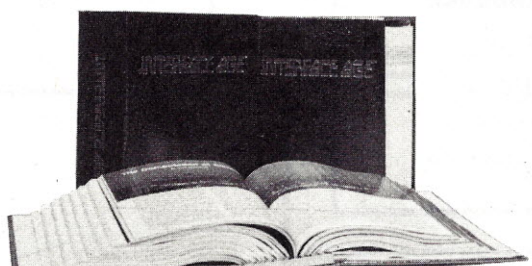

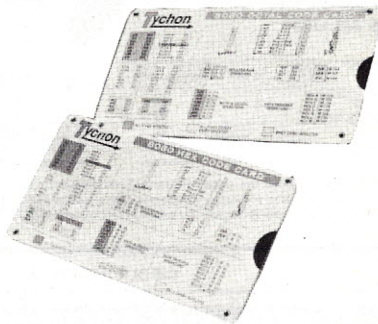

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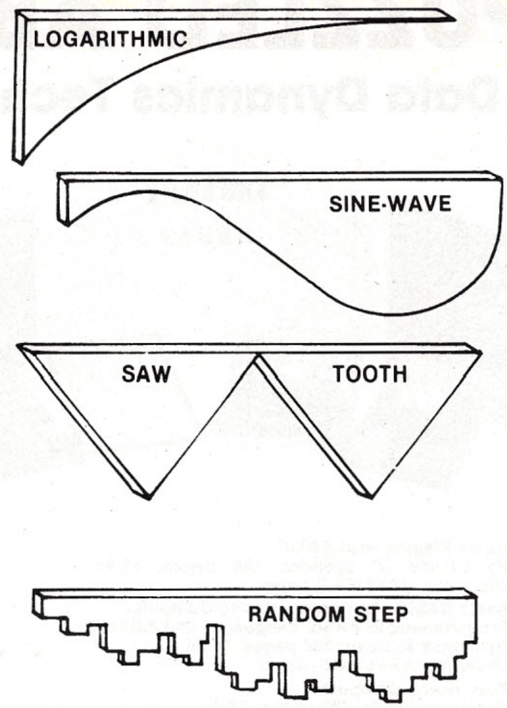

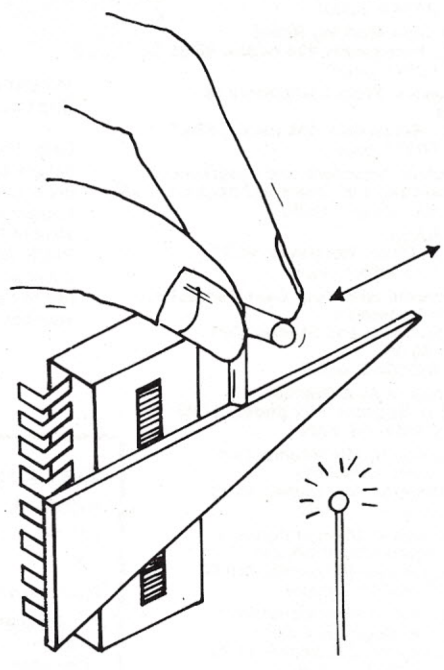

Figure 9. Of course this idea works for more than just rotary dials. We can leave the shadow mask flat, move it back and forth, as above, and we have the digital equivalent of a linear slide potentiometer.

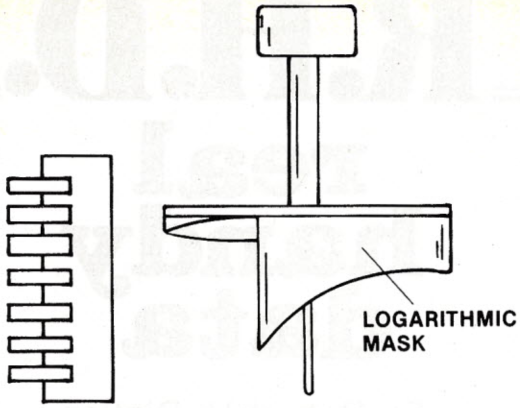

Figure 8. That triangular piece we attached to the disk (which, by the way, we shall call a *shadow mask*) doesn't have to be triangular. The triangular mask gives a nice linear relationship between the dial's rotational position and the corresponding digital readout. But we could just as easily make it a logarithmic or sawtooth or sine-wave relationship simply by using an appropriately shaped shadow mask. In effect, the mask performs numerical transformations that would otherwise have to be done in software or sophisticated hardware.

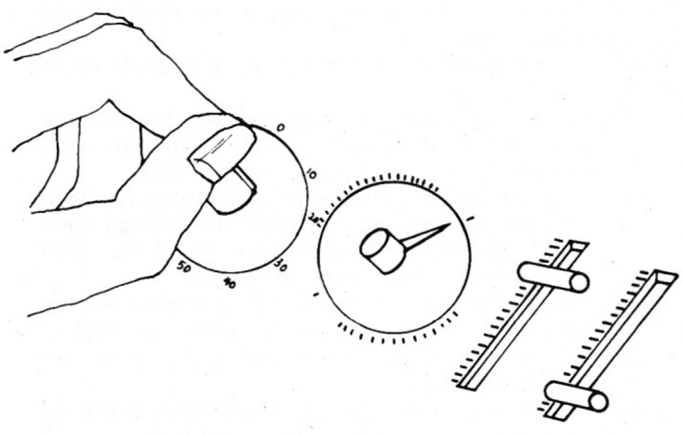

Figure 10. So now would some friendly manufacturer package these ideas nicely (and inexpensively) and sell them to us?

PROGRAMMERS CONTEST

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The prizes include: a two-year subscription to INTERFACE AGE and the publication of your game paid at the prevailing author rates.

HERE ARE THE RULES:

- The game must be written in assembly code for any machine of your choice.
- The game must include all the prime characters in the television show.
- The game cannot be based around ships shooting ships.
- The game can utilize graphics at the start and throughout the game.
- The accompanying article must include how to play the game, and exactly how the code works.

Each submitted game will be judged on creativity, coding style, clarity of the game instructions, and how the code works.

DEADLINE AND SUBMITTAL FORMAT

All submittals must be received at the INTERFACE AGE editorial offices not later than April 1, 1979. Each submittal must be accompanied by a self-addressed stamped envelope and an IAPS formatted tape of the code. The tape must contain both source and object code. The article must be in the format described on page 32a of the March 1978 issue.

Send your entry to Carl Warren, Senior Editor, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, California 90701. Please no phone calls.

R.H.D.

real handy data

By Robert H. Distler

To start this column on "DATABASES" let's look at an INVENTORY PACKAGE sale with Mike and Tim:

Tim: "Hi, can I help you?"

Mike: "I am looking for something to keep track of my inventory."

Tim: "I have a PACKAGE that can handle 12,000 items for just $XXX!"

Mike: "But, will it work for me?"

Tim: "Yes, all you need to know is BASIC programming."

Mike: "How long will it take to get it going?"

Time: "Just a little time."

------------------------etc., etc., etc., ...

This ends with Mike buying Tim's PACKAGE, then what happens? Mike owns a dairy, most of his inventory is age-dated. Many half gallons of milk are dated 01-79, more are dated 02-79 and the rest at 03-79. Tim's PACKAGE, however, has no way of listing these SELL BEFORE DATES, nor can it list how much inventory is going out of date today, nor can it list by NAME; such as MILK ½ GALLON. Instead, Tim's PACKAGE uses a code number that "IT" makes up as new items are entered. This did not work out for either Mike or Tim. Now let's go back and start over.

Mike: "I am looking for something to keep track of my inventory."

Tim: "I am sure that I can help you, but first tell me about this inventory. What is it?" (Tim knows that inventory is something you must define each time.)

Mike: "I own a dairy with three drive-in stores. I need to know at the end of each day how much inventory each one has so I can add to or move it to one of the other stores." (Mike has studied his own needs.)

Tim: "My PACKAGE can give you a list that shows the I.D. number, name, size, unit of measure, amount or number of units, re-order point, and cost." (Tim has studied his PACKAGE.)

Mike: "Can it give me the SELL BEFORE DATE on each item?" (To Mike this is the main problem.)

Tim: "It could be added to the PACKAGE."

Mike and Tim now work out all the detail of Mike's INVENTORY and in a few weeks the PACKAGE is *up and running,* but Mike did no programming.

How did Tim fix that SELL BEFORE DATE? He added 4 digits to the code number 00 to 99 for the month and 00 to 31 for the day. This allowed for eight years before starting over (12 months into 99), and is a number Mike could work with if needed. The LISTOUT is in order of name, size, sell before date, location, amount or number of units and re-order point. Just what Mike needed.

Why did Tim use just two digits for the month and year, and not "Jun 6 1979"?

He is PACKING DATA to save storage room. Just like freeze-dried food, out comes the water before storage, then it is put back in again just before using. PACKING is used in order to get more information *on line*. Packing can be used on other things, not just the date.

For you Tims, look at your data files. Have you packed the data? Things like a dash between month, date and year use two bytes. In 1,500 records that's 3,000 bytes, but don't forget to put them back in your listouts. Be sure you know all the things a PACKAGE needs before you put it *on line*.

If you cannot understand what is needed — do NOT bluff your way. To start and not end is far worse than not starting at all.

But for you Mikes, look at what you're doing now and ask "What can a PACKAGE do for me?" Then, before you buy a PACKAGE, see what it can do, BEFORE NOT AFTER!

If the store or shop that you talk to cannot put their own inventory *on line*, how can they help your inventory? If you cannot understand what they are saying, how is the PACKAGE going to work for you? The store or shop you buy from is the one you are going to work with for the next few weeks, so choose carefully. You can only do that by knowing your own needs. They can tell you how a PACKAGE can meet those needs, but only you can say what they are. This column is written to show you how to state your data processing needs to the so-called computer professional and help the professional understand those needs.

What I need to hear is what type of DATABASE PACKAGE you have or what needs you have for a PACKAGE. Starting next month we will look at some of these.

Bob Distler, P.O. Box 6376, Oxnard, CA 93031, (805) 487-7422. ☐

SYSTEM TO SYSTEM COMMUNICATIONS USING CP/M

By W. C. Hoffer

Eye strain and a "pain in the neck" are common by-products of long periods of time typing at the keyboard. Much has been done to help this problem through the distribution of software on cassettes and diskettes, but both of these have so many "standards" that an equivalent number of systems would be needed to take advantage of those recording mediums. It is also very inconvenient for many to wait for a tape's arrival by mail.

Obviously once a desired piece of public domain software already in use on some computer system is found, it would be convenient to dial that system and effect a transfer via the phone line to a CP/M system. In addition, I wanted to be able to send files from my system to other systems. This would eliminate the need for system compatibility of recording medium or file structure. I also had a need to use the terminal strictly for use with remote time-share systems. This always required manually changing the terminal cable from the microcomputer to the modem and then back again when finished.

It was suggested that one solution might be to add two drives to the BASIC IPUT/OUTPUT SYSTEM (BIOS) and then use the PERIPHERAL INTERCHANGE PROGRAM (PIP) as the implementation tool. This was an effective method and the results are the topic of this article.

There are only a few requirements for using the method described here. You must be running the CP/M operating system, have access to the BIOS source code, have the CP/M CRT: device assigned to an RS-232 port, have the CP/M TTY: device assigned to the system console, and finally, have an external modem or acoustical coupler connected to the CRT: port. I have successfully used a BELL 103A modem, an Omnitec coupler, and a Digicom AC312 coupler.

Consider the modifications made to BIOS. It will be helpful, although not required, for the reader to have a working knowledge of the BIOS part of CP/M.

Figure 1 contains the changes that are required to the LOGICAL DEVICES ROUTINE section of BIOS. Only the CONSOLE IN and READER IN routines have been changed to reflect the labels of the drivers which are shown in Figures 2 and 3. The drivers have been located in the PHYSICAL DEVICES ROUTINES section of BIOS and are self-documenting. Figure 2 contains the code which allows the CP/M system to act as nothing more than a time-share terminal. Figure 3 shows the code that will transfer information from a remote device into a CP/M disk file. The method for transferring a CP/M file to a remote device uses the code in Figure 2 and a standard option in PIP.

```
;
; CONSOLE IN
;
CONIN:      LDA     IOBYT
            CALL    RLCDISPATCH
            DW      TTYIN           ;0: TTY
            DW      CRTIN           ;1: CRT
            DW      READER          ;2: BATCH MODE:
            DW      UC1             ;3: MODEM DRIVER


;
; READER IN
;
READER:     LDA     IOBYT
            RRC
            CALL    DISPATCH
            DW      TTYIN           ;0: TTY
            DW      RDRIN           ;1: HIGH SPEED READER
            DW      UR1             ;2: MODEM DRIVER
            DW      KEYIN
```

Figure 1. Changes to the logical device routine in BIOS.

```
;
; MODEM DRIVER TO TRANSFER INFORMATION
; FROM MODEM TO CP/M DISK FILE
; ECHOS TO SYSTEM CONSOLE
; ECHOS ANYTHING TYPED ON SYSTEM CONSOLE
; TO THE MODEM EXCEPT A CONTROL Z
; WHICH IS SENT TO CP/M
;
UR1:        CALL    CRTSTAT         ;CHARACTER ON MODEM?
            JZ      UR1A            ;NO-CHECK CONSOLE
            CALL    CRTIN           ;YES-GET IT
            CPI     0               ;IS IT A NULL?
            JZ      UR1             ;YES-FORGET IT
            CPI     RUBOUT          ;IS IT A RUBOUT?
            JZ      UR1             ;YES-FORGET IT
            MOV     C,A             ;GET READY TO OUTPUT
            CALL    TTYOUT          ;PRINT ON CONSOLE
            MOV     A,C             ;KEEP CP/M STRAIGHT
            RET                     ;RETURN
;
UR1A:       CALL    TTYSTAT         ;CHARACTER ON CONSOLE?
            JZ      UR1             ;NO-CHECK MODEM
            CALL    TTYIN           ;YES-GET IT
            CPI     CTRLZ           ;IS IT A CONTROL Z?
            RZ                      ;YES-RETURN
            MOV     C,A             ;NO-GET READY TO OUTPUT
            CALL    TTYOUT          ;PRINT ON SYSTEM CONSOLE
            CALL    CRTOUT          ;TRANSMIT OVER MODEM
            JMP     UR1             ;DO IT ALL AGAIN
```

Figure 3. Additions to BIOS for CP/M file transfer to a remote device.

```
;
; MODEM DRIVER TO USE CP/M
; AS A TIME-SHARE TERMINAL
;
UC1:        CALL    TTYSTAT         ;CHARACTER ON CONSOLE?
            JZ      UC1A            ;NO-CHECK MODEM
            CALL    TTYIN           ;YES-GET IT
            RET                     ;RETURN
;
UC1A:       CALL    CRTSTAT         ;CHARACTER ON MODEM?
            JZ      UC1             ;NO-LOOP BACK
            CALL    CRTIN           ;YES-GET IT
            MOV     C,A             ;GET READY TO OUTPUT
            CALL    TTYOUT          ;PRINT ON CONSOLE
            JMP     UC1             ;CHECK FOR MORE
```

Figure 2. Additions to BIOS for the interactive mode.

Figure 4 presents the CP/M system as a time-share terminal to another system. The user typed commands are underlined. Step-by-step instructions are indicated in parentheses. Figure 5 is a block diagram of the interactive mode.

```
A>PIP
PIP - VERS 2.0
*CRT:=UC1:    (Assign the CRT: logical device to the modem driver)

(CP/M is now ready to be connected to the ABC system. Dial
 the number and sign on the system in the normal manner)

(After the phone is answered, ABC responds with:)

U#=HHB53000,PASSWORD

READY

OLD EXAMPLE

READY

RUN

EXAMPLE      08:30PST      07/07/78

THIS PROGRAM IS BEING EXECUTED ON THE ABC TIME-SHARE
SYSTEM USING CP/M AS THE REMOTE TERMINAL.


USED   1.01 UNITS

READY
BYE
0001.01    CRU      000.10    TCH      0000.12    KC


OFF AT 08:36PST  07/07/78


(At this point you are ready to return to PIP. This is
 done by a control Z)

^Z
*^C       (You are now back in PIP. Control C returns to CP/M)

A>
```

Figure 4. Example of interactive mode.

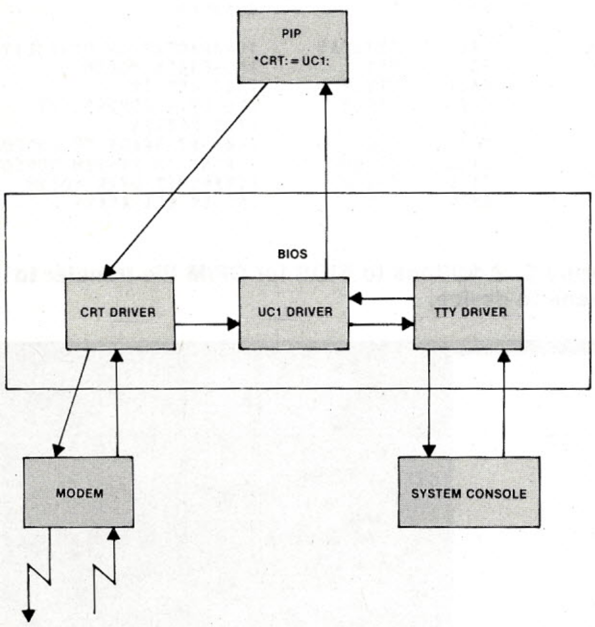


Figure 5. Interactive Mode Block Diagram

Assume that we want to access a commercial service called the ABC Company. (It could just as well be another CP/M system or any other small or large system.) The example shows the ABC system being accessed and a program called EXAMPLE being executed.

The next step is to transfer information from the ABC system to a CP/M disk file. This gives you access to software or data already stored in a computer system. As before, we must first establish communications with the ABC system. Figure 6 shows how this transfer is accomplished and Figure 7 is the block diagram. All information being transferred is printed on the CP/M system console.

```
(The first seven lines are as in Figure 4.)

A>PIP
PIP - VERS 2.0
*CRT:=UC1:
U#=HHB53000,PASSWORD

READY

OLD EXAMPLE

READY

(You now return to PIP and prepare CP/M to receive
 information over the modem and store it in a file.)

^Z     (Control Z returns to PIP)
*CPMFILE.FOR=UR1:

(This not only prepares the file but also returns you to
 the ABC system. ABC is now commanded to list the file.)

LISTNH    (List the file)

(The information will be printed on the console as
 well as being placed in a file.)

100 PRINT 10
100 10 FORMAT(1X,"THIS PROGRAM IS BEING EXECUTED ON THE ABC TIME-SHARE")
120 PRINT 20
130 20 FORMAT(1X,"SYSTEM USING CP/M AS THE REMOTE TERMINAL.)
140 STOP
150 END


^Z     (Control Z returns to PIP)

*CRT:=UC1:     (Return to the interactive mode.)
BYE     (Sign off the ABC system.)

OFF AT 09:30PDT  07/08/78

^Z      (Control Z returns to PIP)
*^C     (Control C returns to CP/M)
A>
```

Figure 6. Example of a file transfer from a remote device to a CP/M file.

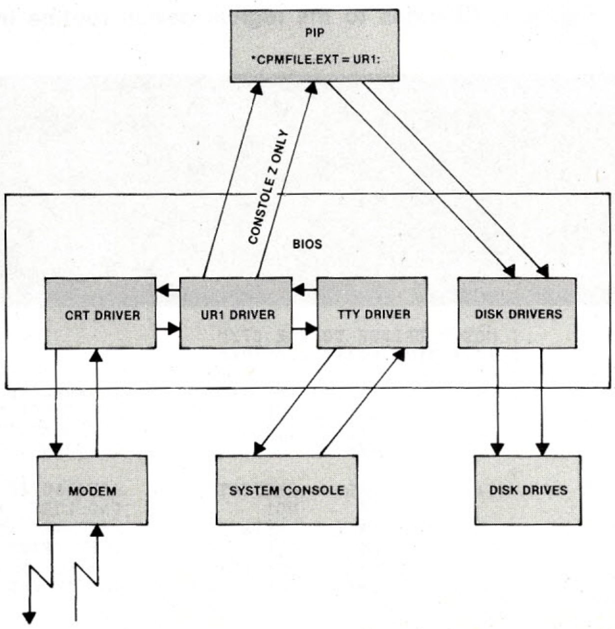


Figure 7. File Transfer from Remote Device to CP/M File Block Diagram.

```
(The first five lines are as in Figure 4.)

A>PIP
PIP - VERS 2.0
*CRT:=UC1:
U#=HHB53000,PASSWORD

READY

(The ABC system must now be told that a new file
 of information is coming in a continuous mode.)

NEW EXAMPLE1

READY

TAPE

^Z     (Control Z returns to PIP.)

(Instruct CP/M to transmit a disk file to the modem.)

*CRT:=EXAMPLE.FOR

(When the file has been transferred PIP will
 respond with an asterick. You will then
 want to return to the interactive mode and
 instruct the ABC system to save the file.)

*CRT:=UC1:     (Return to the interactive mode.)

SAVE    (Tell the ABC system to save the information.)

READY

BYE    (Sign off the ABC system.)

00004.10  CRU     0000.16  TCH     0001.77  KC

^Z     (Control Z returns to PIP.)

*^C     (Control C returns to CP/M.)

A>
```

Figure 8. Example of a file transfer from a CP/M file to a remote device.

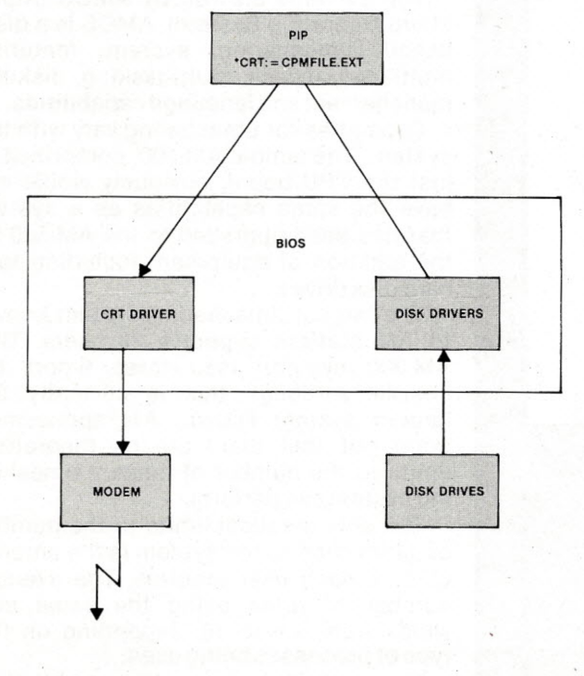


Figure 9. File Transfer from CP/M File to Remote Device Block Diagram.

```
INTERACTIVE MODE

A>PIP
PIP - VERS 2.0
*CRT:=UC1:

(Dial and sign on the remote system.)


TRANSFER FILE FROM REMOTE SYSTEM TO CP/M DISK

*CPMFILE.EXT=UR1:

(Tell the remote system to send the file.)

(The file contents will print here.)

^Z     (Control Z returns to PIP.)


TRANSFER FILE FROM CP/M DISK TO REMOTE SYSTEM

(Prepare remote system to receive file.)

*CRT:=CPMFILE.EXT

(When asterick prints the transfer is complete.)

*CRT:=UC1:

(Tell the remote system to save the file.)

^Z     (Control Z returns to PIP.)

*^C     (Control C returns to CP/M.)

A>
```

Figure 10. Condensed version of the examples.

There is one restriction when using this feature. The information being transferred must fit into the CP/M user area memory. If this restriction is violated, PIP will stop taking data from the modem until it has written the contents of memory to the disk file. The remote computer continues to transmit data while PIP is housekeeping, which results in lost information. A simple solution is to break up a large file into smaller entities.

Finally, if you have taken the time to type in some nice piece of software and would like to share it, follow the steps outlined in Figure 8 which are graphically depicted in Figure 9.

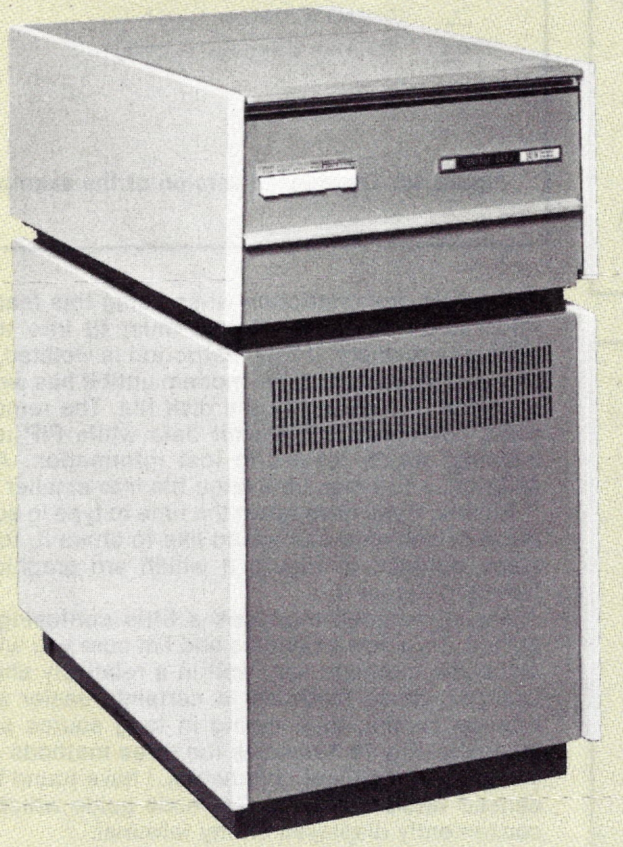
These methods may look a little confusing at first glance. Try a few examples and I'm sure you will understand the methods very well in a relatively short time. Learning these methods is certainly easier and less time-consuming than typing in long source programs manually. Figure 10 shows the three methods in shortened format (without comments). I have found this condensed version a handy reference guide which can be conveniently displayed on my terminal.□

ABOUT THE AUTHOR

Mr. Hoffer began his data processing career in 1966. He has programmed in many of the popular languages and has lectured on FORTRAN at the University of Arizona and at Hughes Aircraft Company. To expand his knowledge of hardware, he acquired a microcomputer system in late 1976. Since that time he has been involved in an on-going evaluation of small systems. Mr. Hoffer is presently employed at Hughes Aircraft Company as Manager of Computing and Data Processing for the Missile Systems Group, located in Canoga Park, California.

TIMESHARING: A Part of With the Alpha Micro

By Terry Costlow, Assistant Editor



For the many persons or businesses that purchased 8-bit machines in the past, only to find out they soon outgrew the limited capacities of the small machines, a costly system changeover was once the only solution.

But when Alpha Micro of Irvine, California, began production of a 16-bit board that was compatible to the popular S-100 bus, users were provided an alternative that allowed them to advance to the world of 16-bit systems without throwing their old systems out. By simply putting Alpha Micro's CPU 2-board set in to replace the old 8-bit board, the big jump could be made.

Since the company introduced the AM-100™ system in 1977, Alpha Micro has continued to develop improvements and uses for the 16-bit board.

TIMESHARING

One of the most important business considerations the AM-100 through AM-500™ systems is timesharing. A real-time (60 Hz) clock on the CPU board allows for multi-tasking, allowing the users to do several jobs at the same time.

The systems are run by AMOS (Alpha Micro Operating System). AMOS is a disk-based timesharing system featuring multi-user access, multi-tasking, disk-file management and language capabilities.

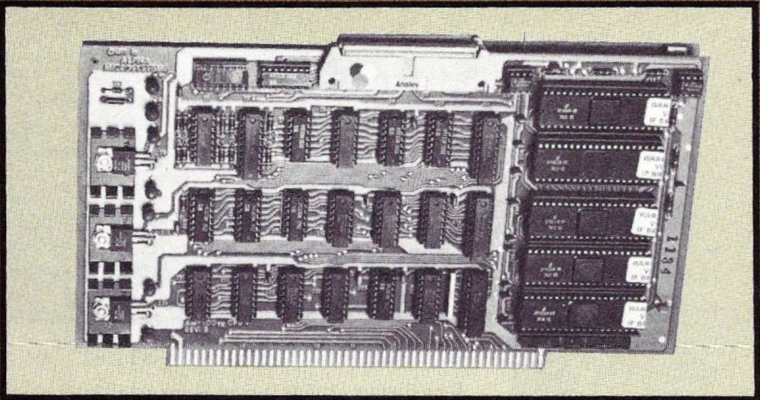
Capacities for timesharing vary with the system. The simple AM-100, comprised of just the CPU board, obviously would not have the same capabilities as a system that had been upgraded to the AM-500 by the addition of equipment including four hard disk drives.

The largest timesharing system known to AM staffers supports 22 users. This AM-300 system uses three 6-port I/O boards. Although this is currently the largest system known, AM spokesmen point out that there are no theoretical limits to the number of tasks a timesharing system can perform.

The only practical limits to the number of users sharing the system is the amount of time each user requires. The average number of firms using the same unit varies from six to 10, depending on the type of processes being used.

The system comes with a protective safeguard, which utilizes a password, to

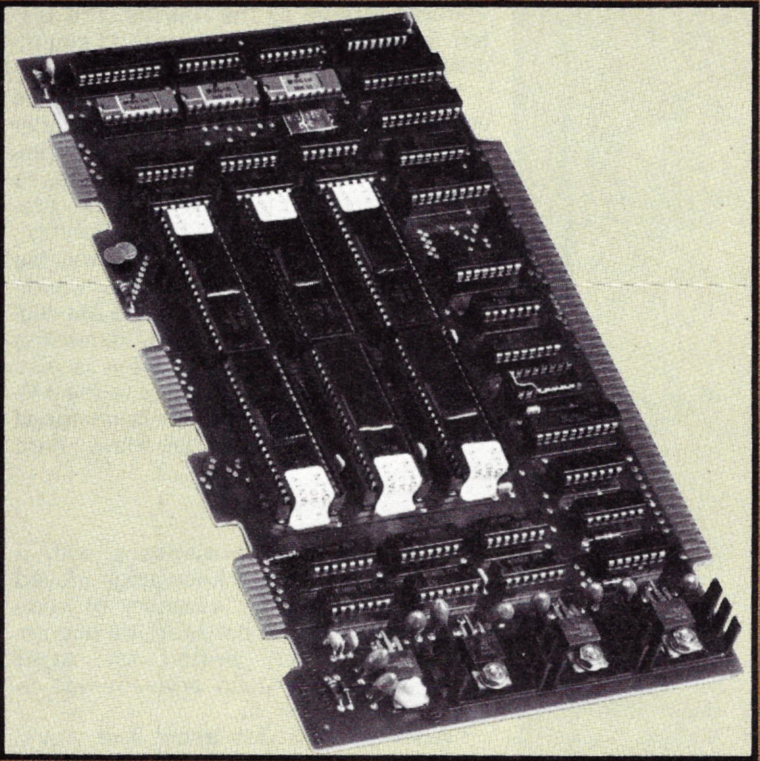
Business System



prevent others sharing the same machine access to company files. The disk can be broken down into several sections, each of them available to the user who knows the code word for that section.

For companies which have offices in different areas but do not want to purchase separate computers for each office, the Alpha Micro system allows for multitasking between the two offices.

By using an additional terminal at the second office and connecting the two units by telephone using modems, the main computer can be working for the outer office at the same time it is being utilized by employees at the main office.



DEVELOPMENT OF THE SYSTEM

The Alpha Micro system was begun in March, 1977, when Richard Wilcox, a self-taught programmer, teamed with Robert Hitchcock and John French to delve into the burgeoning world of microcomputers.

The company began with production of the 16-bit AM-100 CPU, a unit which was designed not only to allow for upgrading of 8-bit machines, but to utilize software that had already been tested.

"Our main intent was to sell our CPU board to the hobbyist," Wilcox said. "But before too long, small business users got wind of our system and began to ask about it."

Those initial inquiries began to multiply, until the company decided to gear its product towards the small businessman, developing it to meet the needs of companies which were purchasing new computers or updating their smaller machines.

"We've been dragged into the mode of professionals because the board is powerful. We've gotten out of the hobbyist market because it will most likely stay like the ham radio market — a relatively small sales outlet," Wilcox said.

Now the system has been developed to the point that the floppy disks which were used in the early days are nearly obsolete for large users, such as Alpha Micro itself.

"I use the floppy disks only for backup. They just don't hold enough storage any more," Wilcox said. He now uses a Trident hard disk, storing up to 2400 megabytes on eight disk drives.

CAPABILITIES OF THE SYSTEM

For those choosing to upgrade their current system using the AM-100 CPU, capacities will be greatly increased by the additional eight bits. The board's increased capabilities can match the throughput of many minicomputers now on the market. Floating point arithmetic, the real-time clock, and additional flexibility are features offered by the AM-100. The system is capable of handling up to 11 significant digits.

The next step up is to the AM-200. This consists of a full DMA floppy controller based on the Western Digital WD-16 chipset. The AM-200 can reformat diskettes to non-standard formats, as well as providing increased throughput and reliability.

The AM-300 provides six programmable RS-232 ports for input and output handling. The next improvement, to the AM-400, is made by adding hard disks, increasing capacity greatly. Greater storage is also available for those stepping up to the AM-500. The interface controller is designed for use with the CDC 9472H (Hawk) hard disk drive.

SOFTWARE

Wilcox started the company with a great deal of software knowledge picked up while working for a variety of companies. Much of the hardware he had designed had been written for larger machines, so the main problem was to adapt it for the micros.

"What we had was about five years' worth of software on many systems," Wilcox said. The Alpha Micro system was designed to take advantage of this time-tested software.

After it was adopted and the CPU board began to sell, the available number of packages and languages has constantly been expanded.

Alpha Micro provides software packages in a variety of languages, all adapted by the company. ALPHABASIC, ALPHAPASCAL and ALPHALISP are currently offered. For timesharing purposes, the ALPHABASIC compiler and runtime packages are written in re-entrant codes so they can be shared by all users.

Some of the software packages that are currently available include the general ledger, payroll, accounts payable, accounts receivable, and order entry/inventory control.

THE COMPANY

When Wilcox, Hitchcock and French teamed together, they combined the knowledge of a programmer, marketeer and a store owner.

French, who owned a computer store that helped to provide an outlet for the fledgling corporation, has since departed from the company.

Hitchcock first got his interest in computers in 1954 when he worked for the Rand Corporation as an associate mathematician. He now serves as the treasurer of Alpha Micro, a company which has been expanding so rapidly that a large wooden carving of the company logo still sits on the floor. A piece of paper hangs on the office door to inform persons the name of the business.

In the 21 months the company has been operational, it has grown from an initial staff of four to now employ 66 workers. The space has increased from a 2,000 square-foot capacity to the current 24,500 square-foot building.

Alpha Micro made a profit in its fifth week and hasn't looked back since. During the first year, sales totaled more than one million dollars.

"We passed a million in the first two months this year," Hitchcock said. It is estimated that sales during the current fiscal year will be about 10 times greater than last year.

Wilcox, called the "architect of our hardware and software" by Hitchcock, began his computer career in 1965. He was em-

ployed as a field services employee in the aerospace division of Honeywell.

A few years later, he moved to USC as a programmer after teaching himself how to program computers. Wilcox later went into consulting, then began designing software. He is now the president of the company.

FUTURE PLANS

"We are continually adding to our product line because we recognize that to compete successfully in our market, we must remain in the forefront of a technology which is constantly seeking new improvements and new products," Wilcox said.

One area that requires constant updates is software production. Changes and additions to the existing packages are always made available to consumers. In addition, new languages and software packages are constantly being implemented.

Although the hardware is also being updated, the company has decided to stay out of some markets.

"We don't want to get into manufacturing peripherals," Chief Engineer John Glade said. "We will make intelligent controls for peripherals, but that's as far as we'll go."

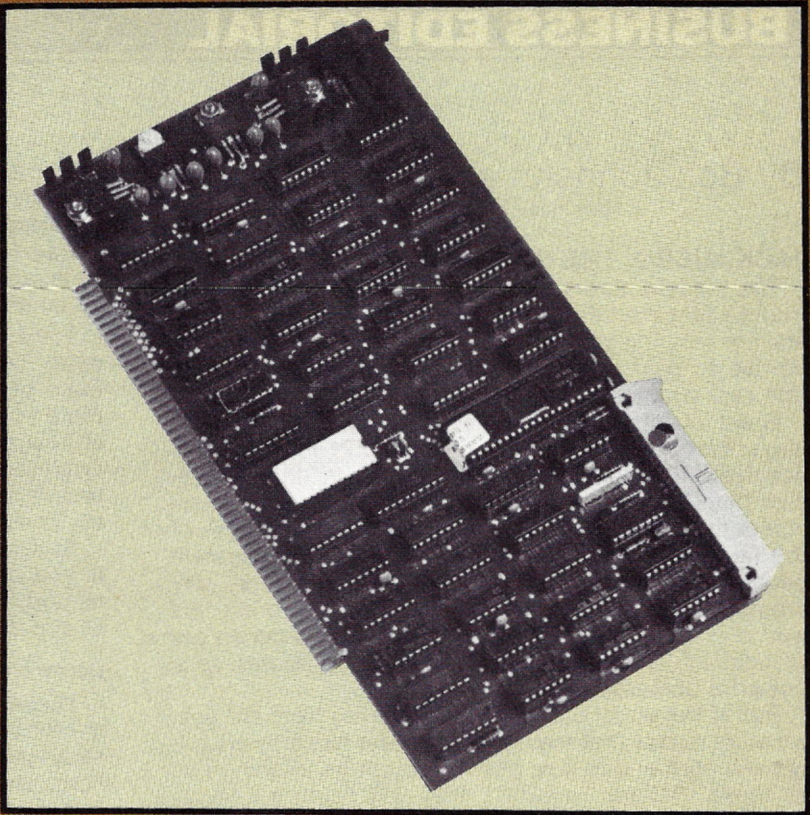
One of the hopes of Alpha Micro is that the S-100 bus will become less of a problem to work with. Some difficulties have arisen because the popular bus has been re-designed several times, making it hard to insert the Alpha Micro CPU board into these non-standard buses.

THE MARKET

The Alpha Micro systems are currently being sold through a network of retail dealers, systems houses and OEMs. The majority of sales are made by the network of 147 retail dealers around the world.

The basic AM-100 system with software sells for about $1,500.

Repairs are handled by factory-trained dealers. A network of service centers across the nation is being started. □



BUSINESS EDITORIAL

By Bob Johnson and Mark Grennan

Business Microsystems

JACK MICRO, THE GIANT KILLER

The manufacturers of small computer systems have found a new market in the small businesses of America and are bringing all their advertising and engineering expertise to bear on the promotion and development of this near-virginal field.

Great claims are being heard, suggesting that the larger systems are archaic, obsolete, and downright expensive. Microcomputer technology is far less expensive than that required to create a mini or mainframe computer and the capabilities are approaching those of the larger systems. It seems that most small system people are suffering from a "Jack-the-Giant-Killer" syndrome. And yet, they are quite justified in feeling this way now that more and more small businessmen are recognizing the potential of a small computer as a powerful business aid.

But, if the larger systems are suffering from old age, we must realize that the microcomputer has only recently been born and is now going through its infancy. Yet as these systems "mature," they will capture increasingly large portions of the business market.

Businessmen should realize some of the shortcomings of the microcomputers on the market and consider *all* available systems before committing to a microcomputer for business applications.

An Open Letter to the Small Systems Manufacturers

Dear Sirs:

I note with interest and enthusiasm your latest entries into the small business systems field, and yet I feel that you have not properly researched that field, for there are still many obstacles to overcome, and I have seen very little effort in several critical areas.

First, you do not provide service for your equipment on a local level. A businessman requires such support to minimize downtime and the loss of revenue caused by such downtime.

This could be remedied by making it profitable for dealers and individuals to establish warranty stations. This is the way most national consumer products are warrantied, and is a fairly efficient, if complex, way to solve the service problems.

But, when questioned about local service availability, the businessman is given the impression that service is not considered to be a major concern. He is told that all problems and complaints will be handled by his local dealer. This is true if he has a reputable dealer. The dealer will handle his service problems. . .until it becomes unprofitable to do so.

Second, although some astounding breakthroughs in hardware have been made, software ranges from only adequate to rotten. Granted, you usually provide capabilities to support CP/M, but even it has limitations.

I feel that it would greatly help your marketing efforts if you would concentrate some effort in designing some data-management oriented operating systems, and some developmental languages which are both business oriented, and take advantage of the facilities offered by your hardware. This may not appear as a great advantage to you or the end-user, but it will greatly aid in the development of applications software for your systems, and increasingly this is becoming a selling point for small systems.

Third, I feel that you must adopt some sort of standards between systems other than the use of ASCII. Ease of modification and interchangeability will promote your sales for specialized applications. The best, although not the easiest method for promoting this interchangeability is in the standardization of your systems (i.e., Bus configurations, file handling, BASIC syntax conventions, etc.)

Still, I feel sure that you will take over the market. But, if you don't pay attention to some of the areas presented, it will be a victory of mere survival, rather than of superior qualifications.

Some Notes for the Small Businessman

These items are weaknesses inherent in many of the microcomputers on the market today. *Please* understand that I am not condemning all small computers, but some are definitely better suited toward business applications than others, for the reasons mentioned.

It is for this reason that a small systems consultant can save you money in the selection and installation of a computer system. It is his job to be thoroughly familiar with the systems available, and to match individual needs to the system(s) which will perform as required. To this end, I strongly suggest the use of a reliable consultant before making commitments to any system.

As a businessman looking at a microcomputer for business, you are, in effect, a pioneer in a new field. If your personal Utopia includes timely and accurate inventory reports, the ability to figure accounts aging in the twinkle of an eye, and run trend-line analysis with the greatest of ease, then these things are indeed possible. But, a vast uncharted wilderness lies between you and the Promised Land, and guides are sometimes hard to find.

Some of the hidden dangers in the journey will include poor service, long delivery times, and extra costs when expanding the system to some special function required by the business. Charlatans and restless natives may try to ambush you on your journey. Choose a dealer, consultant, and software house that will work closely with you. They can guard against most of the dangers involved. When the system is up and running, you will understand that all the time and effort are indeed worth it.

And of course, when you have been receiving those timely and accurate reports on inventory, accounts receivable and aging, and analyses of sales, you will want even more reports and analyses for better management. It is then that you will encounter the last cost of the journey. It will cost more money for those new reports. But then that's what business is about, isn't it? □

All comments, letters, and complaints from the small systems manufacturers should be addressed to: Business Microsystems, 7228 West Reno, Route 5, Oklahoma City, OK 73008.

1978 Microcomputer Survey

During the summer of 1978, INTERFACE AGE polled 2,000 subscribers, asking them 53 questions about their computers, their plans and uses for their systems and some views about the industry. In addition, the readers were asked their thoughts about the magazine.

A total of 870 persons returned the completed questionnaires, a response considered good for this type of survey.

The study showed that most of those interested in micros were relatively affluent and had a college education. Nearly all of the respondents, 98 percent, were males.

Those who owned a computer said they used BASIC as their main language, using it on a system that cost less than $2,000. Most were interested in both hardware and software and had plans to either expand their system at some time in the near future or to purchase a microcomputer if they did not already own one.

Some of the highlights of the five-page survey are listed in the table below.□

1. Persons who own or have access to a microcomputer:	YES — 81% NO — 19%
2. Time spent each week working with the computer:	10-19 hours — 41% 20-29 hours — 34% Over 30 hours — 25%
3. Present investment in personal computers:	Under $1,000 — 43% $1,000-$1,999 — 18% $2,000-$4,999 — 12% $5,000-$10,000 — 18% Over $10,000 — 9%
4. Uses of the microcomputer: (Listed by number of persons answering each category)	Control of household appliances — 404 Games — 299 Business — 273 Research — 167 Word processing — 165 Math — 147
5. Language used: (Listed by number of persons answering each category)	BASIC — 570 Machine — 292 Assembly — 256
6. Language user is most proficient in:	BASIC — 42% FORTRAN — 24% APL — 4% Assembly/Machine — 29% Other — 1%

PERSONAL COMPUTERS NOW IN USE

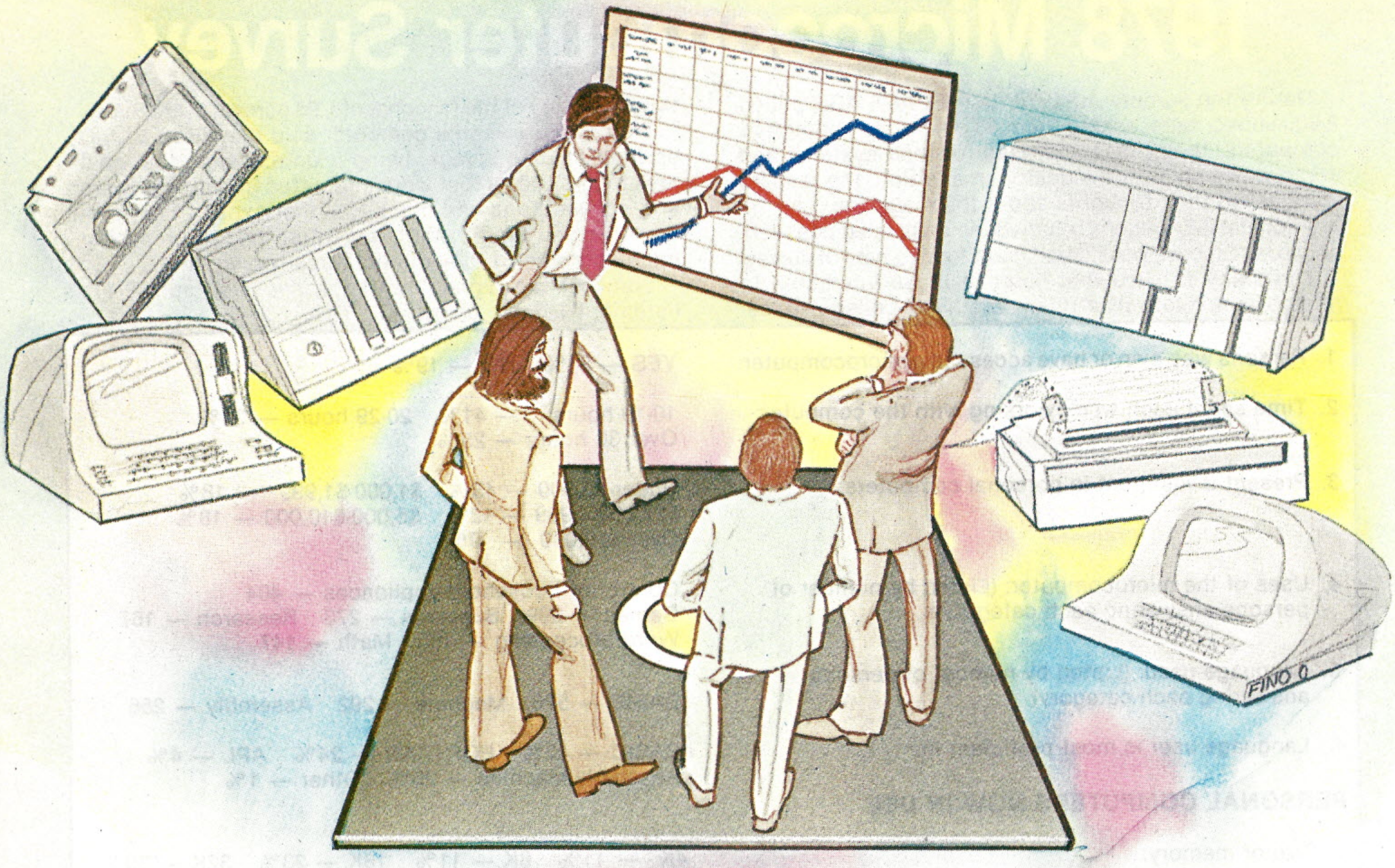
1. Size of memory:	4K — 11% 8K — 11% 16K — 23% 32K — 30% 48K — 11% More — 12%
2. Has memory been added since purchase?	YES — 63% NO — 37%
3. Planning to add memory in the next 12 months:	YES — 65% NO — 35%
4. Form in which microcomputer was purchased:	Kit — 63% Fully assembled — 37%
5. Probability of purchasing a microcomputer in the next 12 months:	Surely buy — 19% Probably buy — 26% Probably won't buy — 32% Surely won't buy — 23%
6. Where the microcomputer was purchased:	Direct from the manufacturer — 45% Local retail computer store — 36% Mail order other than from manufacturer — 12% Other — 7%

7. Factors which influenced which microcomputer the buyer purchased:

	Very Important	Somewhat Important	Not Very Important
Local servicing	7.1%	4.0%	5.7%
Bus support by other manufacturers	9.7%	3.4%	3.6%
Initial cost	9.7%	3.4%	3.6%
Manufacturer's reputation	10.3%	5.7%	1.1%
Power supply capacity	4.5%	5.9%	4.2%
Range of peripherals available	8.2%	6.4%	1.9%

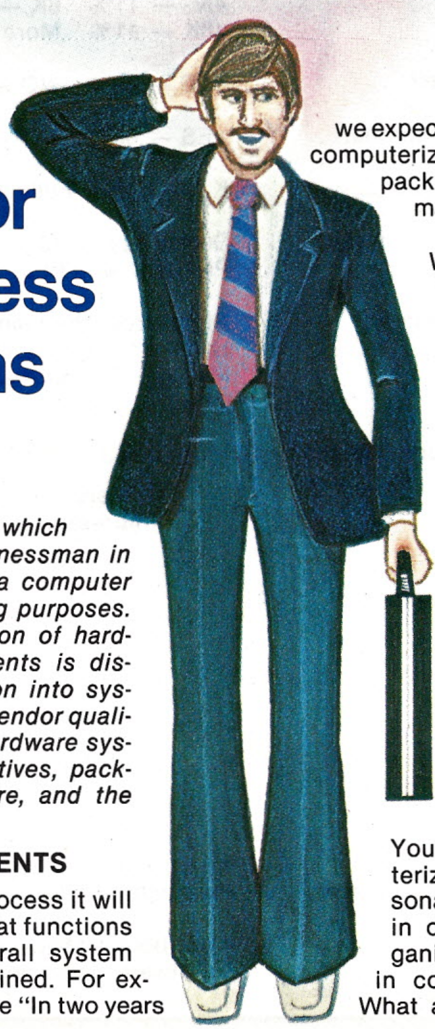
EDITORIAL SURVEY

1. Primary reasons for reading INTERFACE AGE: (Listed by number of persons answering each category)	New products — 242 Business articles — 212 Hardware articles — 375 Software articles — 445
2. View of the magazine:	A use book—15% A general computer magazine—55% A software magazine—20% A hardware magazine—10%



Systems Analysis for Small Business Applications

By R. C. Mooney



The article describes the procedure which may be followed by the small businessman in determining the requirements for a computer system for his business accounting purposes. The procedure for the determination of hardware and mass storage requirements is discussed as well as some orientation into systems software. Also discussed are vendor qualifications for the selection of the hardware system, applications software alternatives, packaged software vs. custom software, and the evaluation of the total system.

DEFINING SYSTEM REQUIREMENTS

As a part of the system design process it will be necessary to precisely define what functions are to be accomplished. The overall system goals and objectives must be outlined. For example, a typical system goal would be "In two years we expect to have our complete order entry processing computerized with the facility for the printing of the packing lists, order acknowledgements, and automatic inventory tallying, as well as re-order lists and vendor accounting."

We must consider and get a firm grasp upon all the desired functions which the system is to perform. The most important thing to remember is to be realistic. Do not attempt to push the system into areas far beyond the state of the art. The system specifications should be defined by the end user of the system based on his own knowledge of the field. Inquiries should be made as to what others are doing along the same lines.

Consideration should be made as to both the immediate system requirements and also the future objectives. Make up a schedule of computer functions desired to be implemented over the next five years (the approximate active life of the system). A good place to start is by analyzing the manual accounting systems which are presently in operation within your organization. Decide which functions are most readily adaptable to computer processing and what future improvements need be made.

You will have a much easier task to computerizing your operations if the paper flow reasonably agrees with the manual system now in operation. By trying to make drastic reorganization all at once you will only succeed in confusing yourself and everyone involved. What are the inputs now available? List all the

inputs to the system which will be required. Analyze the forms or reports which you now use. Whenever possible, the computer inputs should match the forms which are now in use in your manual accounting system. Then follow the same procedure for the outputs desired. Define all the reports, printouts or displays which are required.

Sometimes it may be necessary to more precisely define the manual system of operations before computer systems analysis may begin. Write everything down neatly and in an organized manner but avoid going into excessive detail at this stage.

HARDWARE REQUIREMENTS

Once we have a general idea of what functions the system is to perform, we may define the actual hardware requirements.

The RAM storage requirements will be a function of the operating systems and languages used. For most higher level languages for accounting applications, RAM storage of 24K to 32K bytes should be sufficient for a moderate sized system, that is, provided the operating system has the facility for chained programs or "overlays."

If the programming is to be done by means of a compiled language which does not require any RAM memory for a run-time interpreter, the RAM storage requirements may be reduced. On the other hand, if the system is to involve operations on large arrays of data or matrices, or if complicated sorting must be done rapidly, more RAM storage will be required.

For small business systems the disk or mass memory limitations are more critical than RAM storage. It is this disk storage capacity which will determine the maximum number of accounts receivable, inventory items, etc., which may be kept on file.

Make as accurate an estimate as possible of the bytes per each record or item which must be entered in each file. A good sized inventory record will probably be about 40 to 80 bytes per each inventory item, while an open account customer may require as much as 300 bytes for aged balances and other items per each customer on file.

Realistically determine the maximum number of records which must be kept on file, that is, 1,000 inventory items on file, 300 customers, etc. Mass storage is a finite commodity (at least at the present state of the art), and it is not feasible to try to proceed without getting a firm grasp on the amount of storage which you require for efficient operation.

It may not be required that all computer functions be on-line at all times. For example, the General Ledger file may not be related to the Inventory file, and if you are running with a floppy disk based system, you may remove the General Ledger disk and insert the Inventory disk when inventory activity is required and vice versa. At a later time you may obtain additional mass storage and perhaps a multi-tasking facility (the ability to operate several independent computer functions simultaneously), and then by the purchase of additional hardware, it will be possible for the General Ledger system and Inventory system to be on-line simultaneously.

When you have estimated both the size of each individual record in each file and also the maximum number of records in each file, it is a matter of simple multiplication to obtain the estimate of total mass storage required.

A certain amount of overhead storage will be required for file directories, inefficiencies in disk usage, sector boundaries, etc. Approximately 25% should be added to disk storage requirements for these purposes. This overhead rate should be sufficient for most systems depending upon file directory configurations and sector sizes for hard or soft sectored disks.

All required programs must also be stored on the disk, and requirements for program storage must be estimated and included in the total storage requirements. There is no general rule of thumb for estimating program storage requirements. I have had experience with programs ranging from a simple inventory system which required approximately 12K bytes for the data entry and inventory print programs, to complete accounts receivable billing systems with many software sophistications which required close to 2 megabytes of disk storage for programs alone.

PERIPHERAL EQUIPMENT

Peripherals which may be required will depend upon the actual applications. Most certainly a video display of some type and a keyboard will be required, perhaps more than one. In most cases a printer will be required. Hardcopy is invaluable for origination of new software and also for management reports for typical small business applications.

There are various types of printers on the market. The selection of a printer will depend upon the amount of printing to be done. If a large quantity of printing is required, the user will be better disposed to make the additional initial expenditure for a quality high-speed printer. This is an investment which will pay for itself in the time saved in doing the required printing. Bear in mind, however, that the micro systems on today's market do not have the processing speed of a mainframe type system, and so take care not to select a printer which is designed to run faster than the processor and language interpreters can keep it busy with printing.

For some wordprocessing applications or text editors, a daisywheel type of printer may be desired. These printers have interchangeable character print types for typewriter-like printing. For typical small business systems with average print requirements, a 60 to 120 line-per-minute printer should be adequate.

Other peripherals such as audio tape cassette, barcode readers or other types of optical mark sense, or punched-card equipment may be utilized depending upon the applications intended.

SYSTEMS SOFTWARE

Systems software requirements will vary depending upon the applications and also upon the expertise of the user. Most certainly a monitor of some type will be required to provide for system control from the keyboard terminal and for some type of system initialization such as the loading of a full operating system from the disk upon power-up of the system.

Also a DOS (disk operating system) will undoubtedly be required to handle the housekeeping required for the operation of a disk based system. DOS requirements are a function of both the processing unit, and the disk drive and controllers used in the system. The DOS is very hardware dependent, and unless the user has access to the full schematics and specifications of the processor and all disk interfaces, he should limit his objectives to the DOS supplied by the manufacturer of the system.

The operating system may be permanently loaded in read-only memory in the computer or may be loaded from the disk at time of power-up. The system which is loaded from disk has certain advantages over the ROM type in that the user may obtain various types of operating systems or updated and enhanced versions of the operating system, and these may be loaded at the discretion of the user.

Different programming languages such as FORTRAN, BASIC, PL/1 and Assembler are supplied by various vendors. The selection of required programming languages will depend upon the knowledge of the user and the

overall system requirements. Most business programming is done most easily in some type of high-level language such as BASIC.

COBOL and PL/1 are procedure oriented languages which have gained wide acceptance for business programming on mainframe type systems. These languages have advantages in the software maintenance and documentation aspects of programming but lack the storage efficiency and programming power of BASIC.

FORTRAN is a compiled type of language which was designed for scientific purposes with complete system functions for sine, cosign, log, Alog and both real and complex numbers.

For real-time applications or manipulation of complex I/O devices, the programming is more efficiently done in assembler language. After the source code has been processed by the assembler, the resulting machine language module will run very efficiently and rapidly. Assembler language programming is very hardware dependent, however, and its use should be reserved for those functions which require it. Programming in assembler also requires keeping track of a great myriad of trivial details which are eliminated by programming in a higher-level language.

There are many small systems on the market which utilize either interpretive or semi-compiled types of BASIC, and this is a language which is well suited for business programming. BASIC has the power and flexibility required for complex data manipulations and the storage efficiency and programming ease necessary for microprocessor based systems.

Some of the operating systems on the market today provide the facility for the higher level language program to transfer control to a machine language subroutine. This facility is useful in dealing with unusual peripheral devices or for performing certain types of complex tasks more rapidly, such as sort routines. In these cases the subroutine may be assembled and loaded into RAM memory at the desired location.

When making use of this ability to execute a machine language routine, extreme care must be taken to insure that the existing protocols and conventions of the operating system are not violated. Complete documentation on the usable memory spaces of the system and the interrupt logic must be obtained.

There are certain storage considerations involved in the consideration of various languages. Truly compiled types of languages will execute from a machine language module which is generated by the language compiler or translator. A great amount of machine code will fit into a small amount of RAM, and the program will run very fast compared to interpretive languages. The compiler itself need not be present in the computer RAM at the time of execution of the program, and if the total RAM facilities of the system are small, it is possible to compile the program on another machine which has more RAM available. This makes program changes very difficult and time consuming. However, once the program is debugged and operative, it may be burned into read-only memory for quantity production purposes.

Interpretive languages require an interpreter package of about 8K to 16K bytes of the computer RAM at all times during program execution. The RAM requirements of the interpretive operating system are independent of the storage requirements of the actual applications programming. For example, if the BASIC interpreter occupies 12K of RAM and the total system consists of 16K, there is 4K bytes of RAM available for the applications program. A system of this configuration would dictate the programs be broken down into chained-program links (or overlays) of 4K bytes each. Interpretive languages usually have certain advantages associated with the interpretation scheme such as dynamic data storage allocation for variable character string lengths.

Some languages require both a pre-interpret module and a run-time module. These languages partially compile the source code as it is entered and also require final interpretation at time of execution. This scheme combines the memory efficiency and faster execution time of the compiled system with the dynamic data storage allocation advantages of the interpretive system.

Other software may be considered as systems software such as sort routines, data dictionary and database managers, and report generators. These types of packages are generally written so as to interface with a great many different types of systems.

EVALUATING THE PROSPECTIVE SYSTEM

Once we have outlined the system requirements and have gotten a firm grasp on the RAM and mass storage requirements, there should be no problems in selecting a system to meet these requirements and no later surprises or disappointments because of insufficient computing power. The user may proceed with a systematic evaluation of the various systems on the market.

Decide beforehand approximately how much you wish to spend for computer services. The benefits to be derived from the system may not balance against the total cost, and you may be better off without the computer.

You cannot effectively utilize the system without complete applications software, so do not neglect to include the cost of necessary software as part of the total cost of the system.

Another item which must not be neglected when considering the total costs of the system is the cost of paper, miscellaneous supplies and operations personnel. It will be required that someone be available to handle the elementary data entry functions for the computer. The businessman may have personnel available at least part time to perform this task. There is also the need to have technically competent assistance within easy reach to handle routine software maintenance, new programming, and to help out in case of a system crash. The owner of the small business system may desire to perform one or both of these functions himself; however, good business practice dictates that the owner of the business spend his time taking care of the needs of the business and not playing around with the computer.

There are a great many small systems on today's market, and you are looking for a golden relationship with a vendor who is willing to provide a computer system and the support that goes along with it. This support should include adequate documentation of all levels of the system written in language which you can understand. Complete documentation should include operations manuals on the computer system and all peripherals, the monitor and DOS, programming languages, and all applications software.

Expandability is an important option to acquire. You may find it easier to make the initial purchase of a minimum system and expand later as the need arises. Also, new applications for the machine may be determined at some later date, and it may be necessary to acquire new peripherals or to expand the RAM memory or mass storage capabilities of the system.

If you desire the opportunity of adding new peripherals in the future, you should examine the number of card slots available in the CPU for I/O expansion. A typical motherboard may have 8 card slots of which one is used for the CPU, one for vectored priority interrrupts, one for a dual 8-bit parallel I/O port, one for a dual serial I/O port, two slots for the disk drive controller and DMA card, and

two slots for the 32K memory. This leaves all eight slots filled in the initial system with no room for future expansion. Some vendors may offer an expansion chassis, however, which may be installed to provide more slots.

A system which will operate on programs written in several different languages will be more versatile and there will be less difficulty in obtaining a good applications software. This type of system will also have a higher value should you decide to sell it, since the hardware will be more easily adaptable to some different type of operation.

An important consideration in the selection of a system is the question of maintenance. If the system is to aid in the operation of the business, it must be reliable in the first place. However, should the system go down, there must be the means available to get it repaired.

If the vendor is to take care of all maintenance, you should find out where the nearest service center is located or determine if a representative will be sent to make repairs at your location. If the operation of the computer is vital to your business, you should consider obtaining a maintenance agreement for both routine preventative maintenance and for system crashes. These maintenance agreements may be obtained at a reasonable charge.

If you elect to do your own maintenance, you will require the complete system documentation from the vendor including complete schematics for the processor and all memory and I/O interface cards and PC layouts. It may be helpful to determine where you may obtain replacement parts for the system.

Other important vendor qualifications may help in making the final decision for the purchase of a system. Does the vendor provide training courses of any type for the initiation of the user into the operation and programming of the system? Does the vendor seem cooperative in answering your questions regarding your intended use of the system? If problems arise, can you talk by telephone to someone knowledgeable who may be able to help you out of a jam? When you are considering the purchase of perhaps a $10,000 piece of equipment which is a very complicated device, it is not unreasonable to expect that the vendor extend a reasonable amount of technical assistance since each type of system will have its own unique attributes.

Are there are other systems similar to the one you are considering in operation so that you may contact other users and share ideas and know-how? It may be desirable to make these contacts prior to making the purchase to determine if others are satisfied with the system and if the vendor has been cooperative.

APPLICATIONS SOFTWARE ALTERNATIVES

The complete computer system includes both hardware and software, and good software is absolutely essential for the efficient use of your expensive hardware system. The big question arises: Packaged software vs. Custom software. Good software is not cheap and either way you go you must remember to include the cost of necessary software as part of the total cost of the system.

Because of the intricacies that arise between different types of businesses or even between different businesses of the same type, there is really no such thing as completely standard software. However, the system vendor may offer some applications software packages that you desire. You should determine how closely the software offered by the vendor fits your needs. Can your needs be adjusted to fit the available software? Can the software package be modified to perform the functions which you desire?

By all means, it is better to begin with some software which is similar to your needs and to make modifications as required than to begin completely from scratch. Again, the user is cautioned to work to make the computer fit your business, not to make your business fit the computer. You know your business, and the computer vendors do not.

The possibility of having the vendor perform all necessary software maintenance is feasible. However, you may find it easier to make minor modifications yourself than to explain to the software vendor exactly what it is that you want.

If you desire to modify the vendor's software package, make sure to obtain source listings and related documentation on the program. You should also make clear the legality of making modifications to the package. Most software on the market today is copyrighted, and you will obtain the use of it by means of some sort of license agreement. Normally it is permissible to make modifications to licensed software provided it is for your own use and you do not resell the package.

The generation of custom software is an expensive and time-consuming task. However, packaged software may not be available for the applications which you desire. You have purchased an expensive piece of equipment, and you should strive to obtain the most possible benefit from it. Efficient software may be developed over a period of time either by complete new programming or by modifications to existing packages. Remember that all applications software must be checked with *live user data* and that minor bugs may appear from time to time for many years.

You may elect to take care of the programming and software maintenance yourself or to hire a professional programmer. If you decide to engage a programmer (since you may not have the time or desire to do the job yourself) there are several things you should consider. First, decide what portion of the total cost of your system is to be spent on software. Secondly, define your system and software requirements as completely as possible, and write everything down. This will save both your time and the programmer's time since he must understand your operations before he can begin the programming process. The programmer should be able to help with the definition of system requirements and can help with cost-performance trade offs in order that you obtain the most comprehensive software while remaining within your budget.

Again, the complete programming process includes both the checkout of the programming with *live user data* and the generation of complete documentation for both the operation of the system and detailed software documentation for future program changes. Even such seemingly rudimentary things as bringing the system up from a power-off condition should be written down clearly. Your ace computer wizard may decide to vacation in the Bahamas, leaving you on a Friday afternoon with the rest of your employees clawing at your back for their computer generated paychecks.

Establish a definite scheme for the testing of the complete software. Try to establish a test for each possible alternative which may occur. Remember that even the smallest program change may require the complete checkout of the entire system.

Also, a certain amount of operator training and indoctrination will be required for the complete integration of the system. My experience has been that once the operations personnel get over their initial fear of the "computer" they will begin to enjoy it and you will find that your business is served by more efficient organization, fewer errors, and better management reports. □

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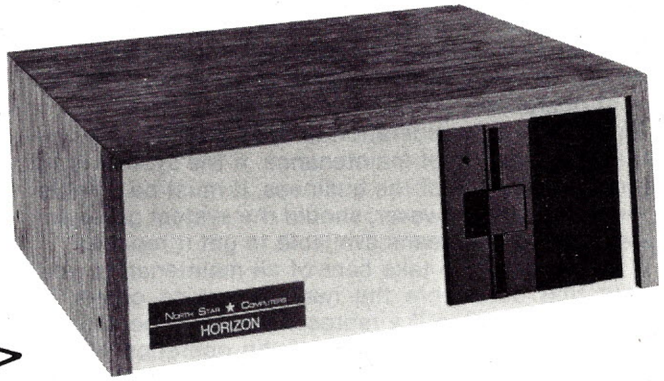

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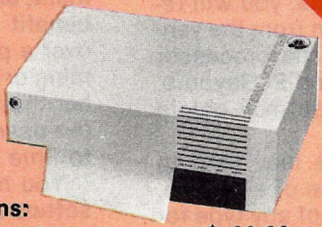

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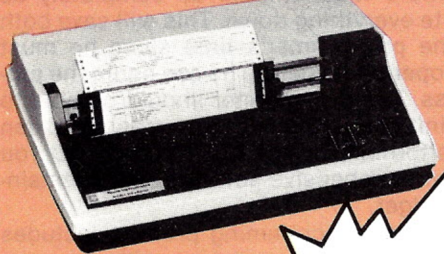

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National Technical Schools Mini-Series of Basic Electronics

NTS mini series

Unit I

By Walter L. Stephens
Assistant Chief Instructor
National Technical Schools, Los Angeles, California

National Technical Schools of Los Angeles is one of a few private vocational schools with an outstanding reputation for providing quality technical training. The school, established in 1905, has more than 73 years of experience in training men and women in a variety of career-vocational programs. In addition to the classroom programs offered in its resident campus at Los Angeles, the school also has a home-study division which offers over 50 courses in electronics, automotive, air-conditioning, and home appliances. These courses are given in English, Spanish and Portuguese. In addition to its main office at Los Angeles, the school has six branch offices in South America.

TABLE OF CONTENTS

This is the first unit of a tutorial series giving the reader a general overview of the computing world with emphasis on the microcomputer and its related home and business applications.

These articles will present the minimum amount of material necessary for those interested individuals to acquire a basic background in computer fundamentals and applications. The experienced electronics technician who is not computer oriented will find the series helpful in the construction of a basic background and useful as a guide for advanced study of the same subject material. For those technicians in the computer field, the series will merely serve as a sequential review.

Table 1 shows the general outline of the series scheduled monthly in INTERFACE AGE. The quiz at the end of each unit is designed as a summary of the preceding material. It consists of 15 multiple choice questions. Inserted at the end of each unit is an answer card the reader may submit to INTERFACE AGE for grading by NTS. National will record the grade and return the card to the reader. A certificate of completion will be given by NTS to the readers who have submitted and passed the summary quizzes. Questions or inquiries about the series must be sent to INTERFACE AGE Magazine, Dept. MS, P.O. Box 1234, Cerritos, CA 90701.

Table 1. Mini Series Outline

1. Introduction
   (a) Outline
   (b) Review of Basic Electronic Principles and Processes
2. Computer Organization
   (a) Analog
   (b) Digital
   (c) Digital Computer Building Blocks
3. Digital Basics I
   (a) Numbering Systems
   (b) Binary Arithmetic
   (c) Boolean Algebra
4. Digital Basics II
   (a) Logic Elements
   (b) Logic Circuitry
   (c) IC-Logic Families
5. Introduction to Microprocessors
   (a) Internal Architecture
   (b) Basic Operation
   (c) Types
6. Memory Devices
   (a) Magnetic Memories
   (b) Semiconductor Memories
   (c) Memory Addressing
7. Process Conversion
   (a) Analog to Digital
   (b) Digital to Analog
   (c) Encoders & Decoders
8. Digital System Operation
   (a) Hardware Timing & Control
   (b) Computer Operating Cycles
   (c) Interfacing Input & Output Devices
9. Software
   (a) Basic Programming Concepts
   (b) Flow Charting
10. Microcomputers I
    (a) Organization & Operation
    (b) Addressing Principles
11. Microcomputers II
    (a) Peripheral Devices
    (b) Interfacing Peripherals
    (c) Basic Programming
12. Microcomputers III
    (a) Programming
    (b) Applications

THE MICROPROCESSOR/ MICROCOMPUTER IMPACT

"What does today's microprocessor have in common with the first practical light bulb?" The average person would reply "lamp bulbs I am acquainted with, microprocessors I am not." The person who is acquainted with both may retort "They can't be compared, they perform two different functions." True, but we are looking for a common ground, not a comparison. Building concepts is much the same as building a house, first the foundation, second the framework and third the roof.

Electricity has been studied seriously from the time of the ancient Greeks. Most of the fundamentals of electricity had been proven in the early 1800's. Perhaps the most extraordinary thing about the light bulb was not so much its invention but its application, hastening the development of power generation and distribution. The first practical light bulb came into being in 1879 and within 3 years the first power generation and distribution station was built. A relative measure of the effect on home users may possibly be emphasized by comparing the number of lamplighters and electrician/technicians in 1879 to the number of lamplighters and electrician/technicians today, 1979.

The eruption of the microprocessor and microcomputer also opened the gate to a new era for the individual. It's an era in which the individual with the proper equipment may personally utilize computer techniques in the processing of information or control of work functions. In the 1950's this would have cost at least a $1,000,000,000. Today the cost will range from approximately $500 and up.

The microprocessor is currently being utilized in many areas of commerce and industry, one of which is consumer products. Within the next few years, newly designed household equipments will be considered "intelligent" or "smart" simply because the design implements a programmable microprocessor. These new appliances in some instances may also be interfaced (married) to a personal microcomputer. Recently a rather "smart" sewing machine made its debut on the market. In a past issue of INTERFACE AGE, a microcomputer program for dressmaking was offered on a recorded disk. The number of applications are vast and in many cases unique; it's foreseeable in the future that almost every individual will have his own personal computer. In addition, consider the various businesses with at least one or two microcomputers in every department.

There is no doubt that because of the power of personal computers, there will be significant changes in our future lifestyles and in technological pursuits. So it was with electricity and the light bulb, changes in lifestyles and technologies followed. These changes were brought about by application.

The common ground that exists between the light bulb and the microprocessor is application!

BASIC ELECTRONICS

The material which follows is equivalent to a course of study in basic electronics. However, because of the limitations imposed by space and reader's time, this first unit will be covered in this and the February issue. This unit is intended to provide a review and summary rather than an in-depth study.

The unit begins with a brief discussion of atomic physics, then proceeds into a review of electro-magnetism, followed by a presentation of the essentials of current flow, voltage, and electrical measurements. From here we go on to review the basic composition of electrical circuits, AC and DC, controls and circuit components. This unit concludes in February with a general description of the functions of modern electronic components such as transistors, diodes, bipolar transistor such as NPN & PNP, and finally FET's.

MATTER

All substances which form our universe are considered matter. Matter is anything that occupies space and has weight, at or near the earth's surface. For example, water, air, copper, gold, iron, wood, etc., are all *matter.*

ATOMS

All matter existing in the universe is formed by the combination of a relatively few number of different tiny particles called *atoms.* All atoms are formed by electric charges. Therefore, all substances found in the universe are really formed by billions and billions of electric charges.

ELEMENTS

A portion of any substance is considered to be chemically pure if it is the same substance throughout. If this substance is formed by atoms of the same kind, it is an *element.* The atoms of an element are alike in weight, structure, and behavior. However, the atoms of each element differ in weight, structure, and behavior from the atoms of every other element.

There are about 110 different known elements. Of these 110 elements, only 92 are found in nature. The others exist only in laboratories or are created as a result of an atomic explosion.

COMPOUNDS

Only the 92 substances found in natural form on the earth are formed by the same kind of atoms. Therefore, all the other substances in nature must be formed by a combination of atoms of different kinds. These substances are called *compounds.*

MOLECULES

Since the great majority of the substances found in the universe are formed by the combination of different kinds of atoms, it is natural to assume that the smallest bit of a compound — that is, the smallest particle of that compound — consists of a certain number of several different atoms. The basic particle of a compound — or the minimum combination of atoms which gives the chemical characteristics to a substance — is called a *molecule.*

STRUCTURE OF ATOMS

The atom is composed of negatively charged particles that orbit around a central nucleus formed of positively charged particles, in much the same manner in which the planets of our solar system orbit around the sun. The negatively charged particles are called *electrons* and the positively charged particles of the nucleus are called *protons.* Besides protons, another particle is found in the nucleus of the atom. This particle does not have any electrical charge and therefore is called *neutron* (based on the word "neutral").

ELECTRONS

The electron is considered as the unit of negative charge. It is the lightest of the three particles previously mentioned. It is so small that it is estimated that if twenty-five trillion electrons were placed in line, they would extend for a distance of only about one inch. Electric currents in wires consist of electrons moving toward a positive potential or voltage applied in the circuit.

PROTONS

The proton is the counterpart of the electron. That is, it is a unit of positive charge. The positive charge on each proton is equal, but opposite, to the charge of an electron.

The good guys still wear white.

Buying a computer is serious business. All computer courses, seminars, lectures, etc, stress one important point; know your needs and know your suppliers, be sure you can rely on them. Khalsa Computer Systems is a retail computer dealership that stresses honesty and integrity, not only as a way to do business, but as a way of life. Wearing white is the reflection of that commitment.

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ELECTROSTATICS

Unknowingly, the Greeks discovered the type of electricity known as static electricity. The Greeks knew that when they rubbed a piece of amber, which they called electron, with a piece of cloth, it would attract other objects such as bits of cloth or pith much like a magnet. From the Greek word for amber are derived the English words electron and electicity.

Originally, static electricity was considered electricity at rest. But with the acceptance of the electron theory which states that electrons are in continual motion in atoms, static electricity is usually thought of as electricity associated with insulators and dielectrics. A dielectric is the insulating material between a pair of oppositely charged bodies. Insulating materials are excellent dielectrics because they contain very few free electrons. Although there is little or no movement of free electrons in a dielectric, a dielectric is capable of transmitting a force from one body to another. The capacitor is an example of two oppositely charged bodies separated by a dielectric which under certain conditions transmits a force.

CHARGED BODIES

A charged body is one that has more or less than the normal number of electrons. It may be either positively or negatively charged. A positively charged body is one in which some of the electrons have been removed from the atoms, creating a deficiency of electrons. A negatively charged body is one in which there are more than the normal number of electrons in each atom; that is, there are more electrons than protons. A body in which there is an equal number of electrons and protons is an uncharged body.

FORCE BETWEEN CHARGED BODIES

Experimentally, it has been proven that charged bodies act upon each other with a force of attraction when they are oppositely charged and act upon each other with a force of repulsion when similarly charged. This is because electrons and protons attract each other; electrons repel other electrons, and protons repel other protons.

FIELD OF FORCE

The region of space around and between charged bodies where their influence is felt is called their electric field of force. The electric field requires no physical or mechanical connecting link but can be applied through air or through a vacuum. Electrostatic field and electric field are other names given to this region of force.

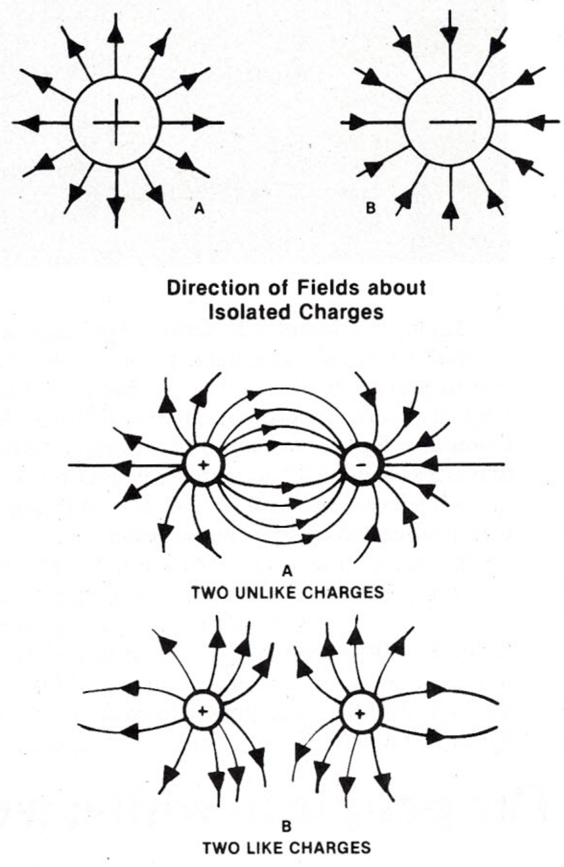
In diagrams, imaginary lines are used to represent the direction and intensity of the field of force. The intensity (field strength) is indicated by the density (number of lines per unit area), and the direction of the field is indicated by arrowheads on lines drawn in the direction a small test charge moves or tends to move when acted upon by the field of force.

Either a small positive or negative test charge can be used to check the direction or force, because the force of an electrostatic field will act on either. Arbitrarily, however, it has been agreed to use a small positive charge when determining the direction of an electrostatic field. The test shows that the direction of the field about an isolated positive charge is away from the charge, for a positive test charge is repelled; and that the direction about an isolated negative charge is toward the charge. From this, one can see that the direction of the field between the positive and the negative charge is from positive to negative (Figure 1).

In the illustration showing the electric field about like and unlike charges, notice that the lines of force apparently repel each other. Although the two charges are attracted, the lines of force between them are not parallel. They bulge out at the center as if they were repelling each other, and are in the same direction; that is, from left to right on the page. At B, the lines of force located in the region between the charges cause their bent appearance. They also are in the same direction. Thus, instead of saying that like charges repel, the law can be modified to say that electric lines of force in the same direction repel each other. This rule, you will find, is very convenient and useful in dealing with certain electrical phenomena.

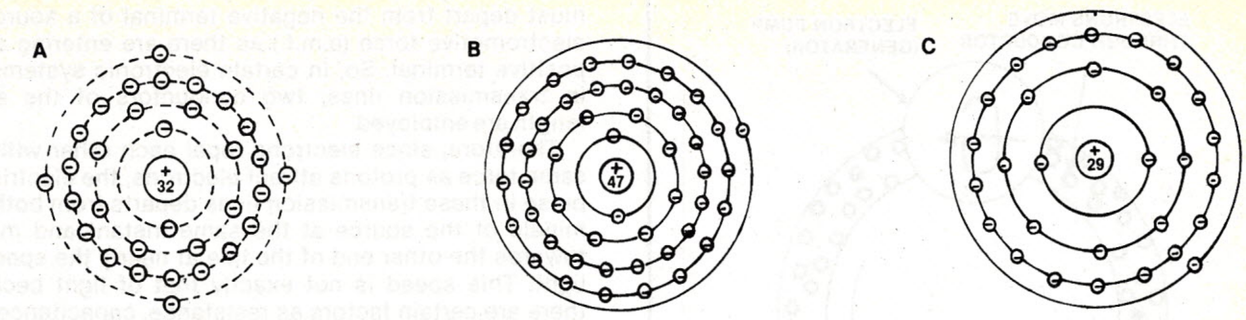
DISTRIBUTION OF CHARGES

Michael Faraday, the famous English scientist, and others proved that charges on various shaped objects distribute themselves according to a fixed pattern. For example, in a hollow sphere charged either positively or negatively there is no electrical field on the inside, but there are uniformly distributed charges on the outside. On pointed objects, charges tend to accumulate on the pointed parts. Thus, on a charged, tear-drop shaped object, the intensity of the electric field is greater in the region of the sharp point. Use of this fact is made in the design of spark gaps. In spark plugs, the shape of the electrodes determines the voltage at which a spark jumps across the spark gap. The sharper the points, the lower the voltage at which the spark will jump for a given separation of the electrodes.



Dielectric Fields about Like and Unlike Charges

Figure 1.



ATOMIC STRUCTURE OF GERMANIUM
ATOMIC NUMBER: 32
ELECTRONS IN SHELLS: 2-8-18-4

ATOMIC STRUCTURE OF SILVER
ATOMIC NUMBER: 47
ELECTRONS IN SHELLS: 2-8-18-18-1

ATOMIC STRUCTURE OF COPPER
ATOMIC NUMBER 29
ELECTRONS IN SHELLS: 2-8-18-1

Figure 2.

LAW OF ELECTRIC CHARGES

A fundamental law of electricity is that electric charges of the same polarity repel each other and, on the contrary, electric charges of opposite polarities attract each other. Since the charges of the electron and proton are equal, two protons repel each other with the same force as two electrons repel each other. They also attract each other with the same force.

DISTRIBUTION OF ORBITAL ELECTRONS IN ATOM

As mentioned before, we imagine the atom as a miniature solar system in which electrons (negative charges) rotate around a central nucleus which contains protons (positive charges) and neutrons.

In Figure 2, we illustrate the distribution of the electrons rotating around the nucleus of the atoms of silver, copper and germanium. In reality, the electrons do not rotate around the nucleus in a two dimensional plane, but rather in a three dimensional plane. Figure 2 illustrates the distribution of the electrons in so-called "shells."

Every atom contains one or more electrons whirling in orbits around the nucleus. These electrons are called *bound electrons* because they are held in their orbits by attraction of the positive protons in the nucleus.

NEUTRAL ATOMS

In normal conditions, every atom is characterized by the absence of an electric charge. That is, matter in its normal state does not exhibit its electrical nature, so it is natural.

This condition is due to the fact that the number of bound electrons in a neutral atom is equal to the number of protons in its nucleus. Since the total charge of the bound electrons and protons is equal, but opposite, their electrical fields neutralize each other and the atom does not exhibit any outside charge.

If an atom loses an electron, the atom is no longer neutral because the nucleus will have a positive charge larger than the negative charge of the bound electrons. An atom in this condition has a positive potential and tries to re-establish its electrical equilibrium by taking an electron from a neighboring atom.

When an atom has one electron more than required, the atom is no longer neutral because the electric field of the electrons is greater than the positive potential of the nucleus. An atom in this condition has a negative potential.

An atom which is in either of the two previous conditions is called an *ion.* In the first case, the ion is positive; in the second case, it is negative.

ELECTRON SHELLS IN ATOMS

In an atom, the bound electrons fill each shell in turn, starting with the shell closest to the nucleus.

The exact manner in which the electrons fill the various shell configurations is very complicated. However, the important fact to remember is that the number of electrons in the outermost shell of any element can be any number from one to eight, but cannot be greater than eight.

When an atom has eight electrons in its outermost shell, this shell is filled, the atom is "stable" and shows little inclination to combine with any other atoms.

The important point to observe, shown in Figure 2, is that the atoms of certain elements have but one, two or three electrons in the outermost orbit and such atoms have a tendency to give these electrons to another kind of neighboring atom whose outermost orbit is nearly saturated (almost full with eight electrons).

CHEMICAL REACTIONS

Chemical reactions are due to interactions between the outermost orbit electrons of the various atoms called *Valence electrons.*

FREE ELECTRONS

Metals are normally good conductors of electricity because of the ease with which they give up the electrons in their outermost orbit.

If the outermost orbit is at a considerable distance from the nucleus, that is, if there are many intervening orbits — and if the atom has but one electron in this orbit, it can release this electron more readily than an atom that has but a few orbits or more than one electron in the outermost orbit.

Due to this fact, we find that in certain metals such as copper, silver, gold, etc., the electrons of the outermost orbits become detached from their atoms and wander about more or less freely inside of the metal. They are then known as *free electrons.*

Even though a particular electron may not remain free for a long period of time, there are so many electrons in a tiny piece of metal that, in any given instant, there are millions of free electrons. If these free electrons were made to move by means of an electron pump, they would flow in the same form as water in a pipe when it is pushed by a water pump.

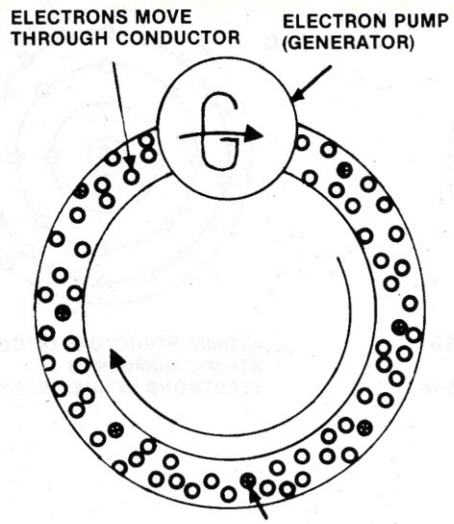


Figure 3.

ELECTRIC CURRENT

Let us analyze what happens in a metallic loop, shown in Figure 3, into which a generator that can be likened to an electron pump is inserted.

This generator produces a force on the electrons, tending to make them move in the direction indicated by the arrow. This force influences all the electrons of the metallic loop — free and bound electrons.

The effect of this force on the bound electrons will be small, but the free electrons will be made to move and will readily circulate around the loop in the direction indicated by the arrow. This flow or circulation constitutes an electric current. The loop, in this case, is an electric conductor.

SPEED OF ELECTRICITY

Within the conductor, the electrons move relatively slow, because the electrons must flow between the molecules of the conductor substance. However, the electric impulse is transmitted through the conductor at nearly the speed of light (186,000 miles per second). This apparent contradiction can be explained by the example in Figure 4.

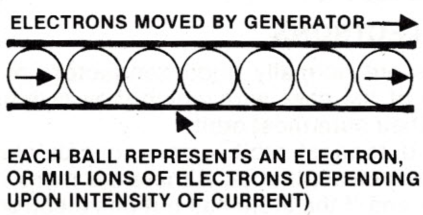


Figure 4. How electric impulse moves electrons.

In Figure 4 we imagine the electrons as small balls within a tube. If we push the first ball at the left, this ball may move only a few thousandths of an inch. It will be enough to cause this first ball to push the next ball and this ball to push the next, etc. Since the balls are touching it is the same as if a solid bar were pushed. That is, the ball at the right end will move at the same instant that the ball at the left is pushed.

In a similar way, the electric impulse is transmitted practically instantaneously, even though the electrons travel at a relatively slow speed.

As already explained, the same number of electrons must depart from the negative terminal of a source of electromotive force (e.m.f.) as there are entering at its positive terminal. So, in certain electronic systems, as in transmission lines, two conductors of the same length are employed.

Therefore, since electrons repel each other with the same force as protons attract electrons, the electric impulse in these transmission lines departs from both terminals of the source at the same instant and moves towards the other end of the line at nearly the speed of light. This speed is not exactly that of light because there are certain factors as resistance, capacitance and inductance that delay the speed of the impulse wave.

DIRECTION OF ELECTRIC CURRENT

Based on the electron theory, one can surmise that the electric current in a metallic container is produced by a flow of electrons that moves through the conductor from the negative terminal toward the positive terminal of the source voltage.

However, in ionized gases as well as in certain solutions in which the chemical elements are ionized (called electrolytes), there are two currents flowing in opposite direction — one caused by electrons flowing from the negative towards the positive electrode and another current caused by positive ions flowing from the positive towards the negative electrode. In semiconductor materials, we consider two effects, *electron flow* and *hole flow.* The direction of electron flow is negative to positive, while the direction for hole flow is positive to negative.

MAGNETIC PROPERTIES OF MATERIALS

A few materials have a constant permeability (M) equal to unity. These substances are called *non-magnetic* materials. Wood, paper, glass, etc., are materials of this type. By constant permeability equal to unity, we mean that the ease with which the material permits the formation of a magnetic flux is equal to the ease with which the field is created through air.

A few materials have a constant permeability very slightly less than unity, which means that they have less permeability than air. These are called *diamagnetic* materials. Antimony, phosphorus, bismuth, sulphur, silver, mercury and copper are examples of diamagnetic materials.

Other materials have a constant permeability slightly greater than unity, that is, greater than air. These are called *paramagnetic* materials. Examples of paramagnetic materials are: Palladium, platinum, tungsten, magnesium, and aluminum.

There is another group called *ferromagnetic* materials, nearly all of which contain iron, wherein the permeability is much greater than unity. In order to understand the behavior of these ferromagnetic materials — notably iron, steel, nickel and cobalt — let us first examine their physical nature.

MAGNETISM IN IRON

Each electron within an atom rotates around a nucleus. However, besides this movement, each electron spins about its own axis in the same manner that the earth spins on its axis, at the same time that it rotates around the sun.

In the atom, the electrons do not all spin in the same direction. An electron spinning in one direction is said to be plus, while a spin in the opposite direction is said to be minus. In the majority of elements, there is a balance between the plus and minus spins of the electrons within the atoms. But in the atoms of iron, an unbalance exists.

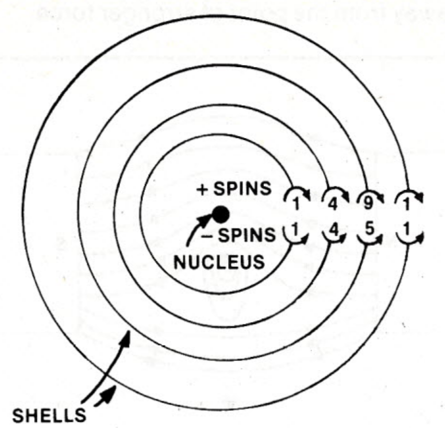


Figure 5. Unbalanced Electron Spin in Iron Atom.

The atom of iron has 26 electrons arranged in four shells, as illustrated in Figure 5. Notice that there are two electrons in the first shell, eight in the second, fourteen in the third, and two in the fourth or outer shell. Note also that in all shells, except the third, an equal number of electrons have plus and minus spins, producing shells that are magnetically neutral.

Remember that the movement of an electron creates a corresponding magnetic field around its path of motion and that the direction of magnetic field depends upon the direction of movement of the electron. If the electrons are moving or spinning within a shell of the atom in opposite direction, the magnetic fields will likewise be in opposition to each other. So if a shell contains a number of electrons with plus spins and an equal number of electrons with minus spins, the shell is magnetically neutral.

In the third shell, however, nine electrons spin in one direction and five in the other, resulting in an uncompensated spin which is the first requirement of a ferromagnetic material. This means that a definite magnetic field manifests itself as a result of this difference in spins.

The second requirement for a ferromagnetic material is that in a group of adjacent atoms, the uncompensated electron spins be parallel to each other. This parallelism will occur when there is the proper relation between the diameter of the atom, for under this condition, the electron charges and spins that occur in adjacent atoms influence each other sufficiently to bring about this parallelism without the application of any external magnetizing force.

These regions where a condition of parallelism exists are called *domains.* These domains occupy volumes roughly equivalent to that of a cube about .001 in. on a side and contain about 10^{14} atoms. Each domain constitutes, in effect, a permanent magnet.

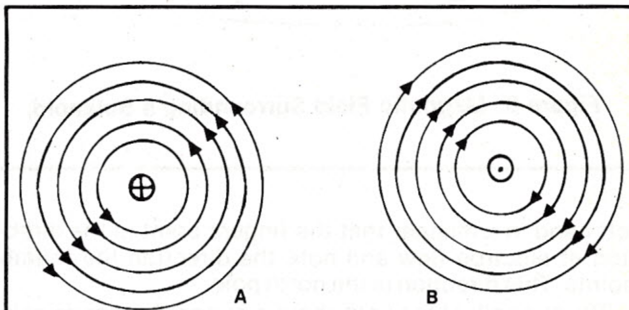
The numerous domains in a sample of iron are ordinarily oriented at random. For this reason, the iron does not exhibit magnetic properties until a magnetizing field is applied by some external means.

ELECTROMAGNETISM

Over a century ago, Oersted, a Danish physicist, discovered that a current-carrying conductor is surrounded by a magnetic field.

The lines of force about a current-carrying conductor travel in either a clockwise or a counterclockwise direction, depending upon the direction of electron flow. At A in Figure 6, the electrons are moving into the page. In this case, the direction of the field about the conductor is counterclockwise. At B, the electrons are moving out of the page and the direction of the field is clockwise.

To determine the direction of the lines of force about any conductor, use the left-hand rule which states that if you grasp a conductor with your left hand in such a manner that your thumb points in the direction of electron flow, your fingers will indicate the direction of the lines of force.



Magnetic Fields about Conducting Wires

Figure 6.

MAGNETIC FIELD ABOUT A LOOP

If you bend the conductor into a single turn loop as shown in Figure 7, the lines of force will concentrate within the loop. This concentration is due to the fact that all lines of force enter the loop from one side and leave at the other.

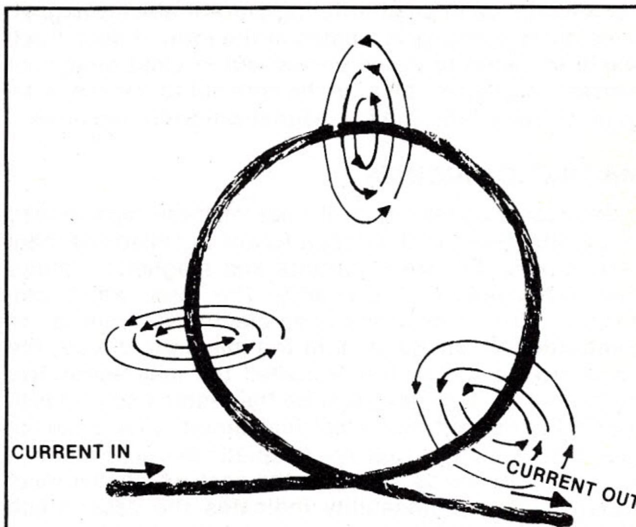


Figure 7. Effect of Loop on Fields

FIELD IN A SOLENOID

If several turns of wire are wound close together into a coil, the magnetic fields about each turn will all have the same direction. When the length of the coil is longer than the radius, the coil is called a solenoid.

When current flows through it, the coil (or solenoid) is surrounded by a magnetic field like that shown in Figure 8. One end of the coil is called the north magnetic pole, and the other, the south magnetic pole. To determine the polarity of a coil use this rule. Grasp the coil with the

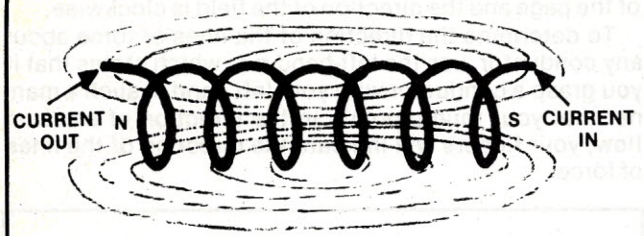


Figure 8. Magnetic Field Surrounding a Solenoid.

left hand in a manner that the fingers point in the direction of electron flow and note the direction the thumb points. This direction is the north pole.

The strength of the field about a solenoid depends only upon the magnitude of current and the number of turns per unit length. Inserting a soft iron core into a solenoid greatly increases the number of magnetic lines of force.

MAGNETIC FLUX

The total number of lines of force occupying a region of magnetic activity is called the magnetic flux and is represented by the Greek letter Φ.

HYSTERESIS

When a piece of iron is magnetized, considerable energy is expended in lining up the molecular magnets in the iron in a definite direction. Therefore, when they are aligned first in one way, and then in the other many times per second, as in an alternating current electromagnet, considerable energy is wasted in the form of heat. Such waste is called hysteresis loss and in electromagnets causes the magnetization of the core not to reverse polarity at the same time that the magnetization current does.

MAGNETIC CIRCUITS

Because magnetic flux of lines of force form closed loops, the path the flux loops follow is called the magnetic circuit. Electrical circuits and magnetic circuits have many points of similarity. The force which produces a flow of electrons in an electrical circuit is the electromotive force(e.m.f.). In the magnetic circuit, the force producing the flux is called the magnetomotive force (m.m.f.). Similarly, just as the resistance opposes the flow of current in an electrical circuit, reluctance opposes the magnetic flux in a magnetic circuit. Similarly, just as conductance indicates the ease which electrical current flows, permeability indicates the ease which magnetic lines of force flow in a magnetic circuit.

FORCE ON A CONDUCTOR IN A MAGNETIC FIELD

When a current-carrying conductor is located in a magnetic field, the interaction of the field about the conductor and the magnetic field exerts a force upon the conductor. By tests, it can be proved that this force is proportional to the flux density, the current, and the length of the conductor.

The principle of magnetism which makes possible the operation of electric motors is that when a current-carrying conductor is placed in the field produced by two magnetic poles, the field about the conductor and the field between the poles react to produce a force which causes the conductor to move either upward or downward. A rule of magnetism is that a current-carrying conductor which is located in a magnetic field is always pushed away from the point of stronger force.

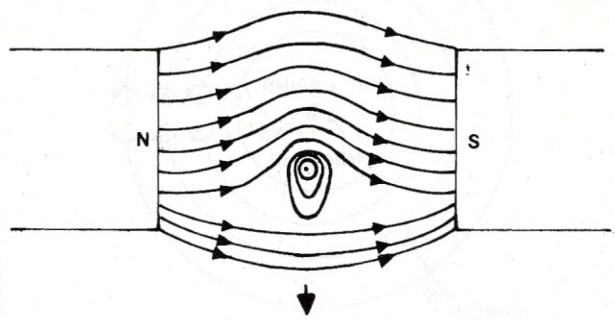


Figure 9. Composite Magnetic Field about Conductor Located Between Magnetic Poles.

INDUCTION

In 1831, Michael Faraday performed a simple experiment with a coil and permanent magnet and discovered that a galvanometer connected to a coil would deflect in one or the other direction, depending on whether the magnet was being thrust into or being removed from the coil. At that time, it was known that a battery, the only known source of e.m.f., caused current to flow through a circuit. Faraday concluded that electrons flow through the coil when there is relative motion between the coil and magnetic field of the magnet, and that an e.m.f. is being induced into the coil.

QUANTITATIVE LAW OF INDUCED EMF

It was noted that a current is produced while a magnetic field is changing and that an induced e.m.f. produces this current. Actually, the induced e.m.f. is the primary effect and the current only the secondary. The law which expresses the magnitude of the induced e.m.f. is: Whenever the magnetic flux through a coil changes, an e.m.f. is induced in the coil equal to the rate of change of the flux multiplied by the number of turns in the coil.

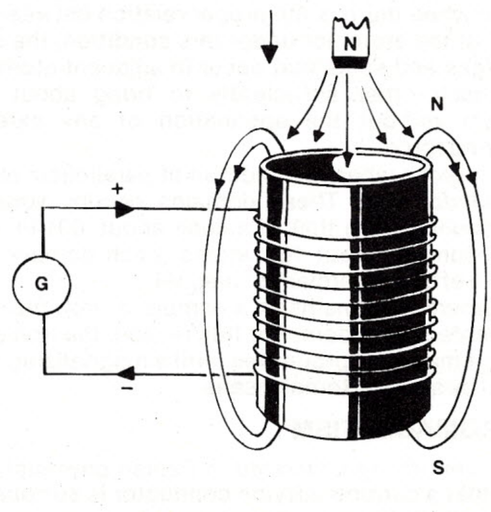


Figure 10. Inducing Voltage in Solenoid by Moving Magnet.

LENZ' LAW

H. Lenz, a Russian, in 1834, summed up induction in the form of a law used in many cases to predict direction of induced current and voltages. Lenz' law is: Whenever an induced current is produced by any motion, current will flow in a direction such that mechanical forces will be produced which oppose the motion.

MUTUAL INDUCTION

In an electrical circuit, a change of current is always accompanied by a change in the magnetic field surrounding the circuit. If the current is increasing, the field is said to be expanding. That is, its intensity at any particular point is increasing. On the other hand, if the current is decreasing, the field is said to be collapsing or decreasing in intensity. When a conductor is placed within the magnetic field of a circuit in which the expanding or collapsing lines of force cut the conductor, a voltage will be induced in it.

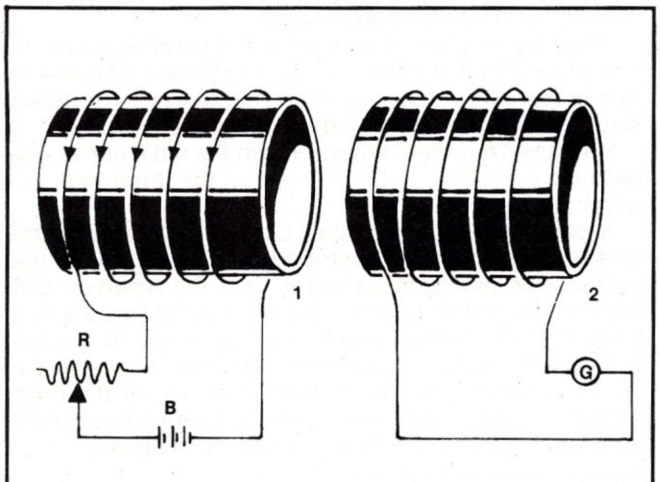


Figure 11. Mutual Induction

GENERATORS

Whenever a conductor moves in a magnetic field in such a way as to cut across lines of force, first in one direction and then in the other, an alternating voltage is induced in the conductor. Current arising from this voltage flows first one way, then the other. A current which reverses direction periodically is called an alternating current (AC). On the other hand, a current which flows continuously in the same direction is called direct current (DC).

A generator which produces an alternating current and voltage is called an AC generator. One which produces DC is called a DC generator. Essentially, they are alike. Their principal difference is in the method in which the generated energy is taken from an AC generator by slip rings and from a DC generator by commutators. Internally, both produce voltage in the same manner.

DIRECT CURRENT ELECTRICITY/ ELECTRICAL QUANTITIES

The unit of electrical charge or the unit quantity of excess electrons is the coulomb. The coulomb is the charge on a single charged body containing 6.28×10^{18} free electrons. For practical purposes this unit is quite large, but it is important in that it serves to define other units.

Current is the movement of electrons through a conductor. The total amount of charge transferred by moving electrons is measured in coulombs or fractions of

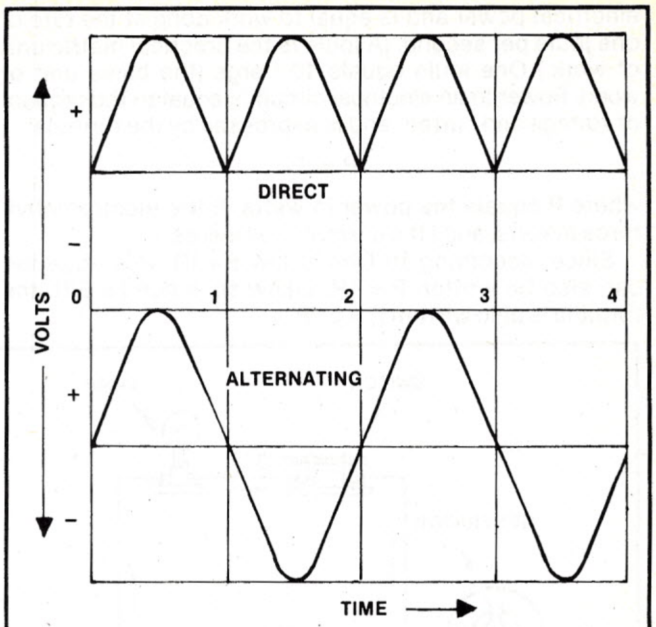


Figure 12. Waveforms of Simple DC and AC Generators.

coulombs. The rate at which they flow is measured in amperes. An ampere is equal to one coulomb passing a given point per second.

The opposition which a conductor (or insulator) offers to the flow of electrons is called *resistance.* For any given conductor, the resistance depends upon the cross-sectional area, the length, and the relative resistance of the material.

On many occasions resistance, or opposition, is of value to us; we then deliberately introduce additional resistance into the circuit in order to control the flow of electricity. In fact, it is the resistance offered to the flow of current by the lamp filament which causes the filament to heat to such a high temperature as to produce light.

The external force or electrical pressure which tends to produce a flow of electrons is known as *electromotive force* (e.m.f.), potential difference, or voltage. All these terms practically mean the same thing and are used interchangeably.

The unit of e.m.f. is the volt. The volt is the amount of electrical pressure required to maintain a current of one ampere through a resistance of one ohm.

Another term relative to e.m.f. is voltage drop. Voltage drop implies that the voltage (e.m.f.) has been reduced by elements that oppose current flow and that there is a difference between the original voltage and the new voltage. This difference is called the drop or the voltage drop.

OHM'S LAW

A very useful relationship exists between the volt, the ampere, and the ohm. This is stated in various ways. The relation between the volt, the ampere, and the ohm is known as Ohm's law, in honor of the discoverer. It states that in any circuit or part of a circuit, the current in amperes is equal to the electromotive force in volts divided by the resistance in ohms. Mathematically, this is stated, $I = E / R$, where I represents the current in amperes, E represents the voltages and R the resistance in ohms. Other ways of stating this formula are $E = IR$ and $R = E / I$.

Another factor to be considered in electricity is *power.* Power is the rate of doing work. The watt is the unit of

electrical power and is equal to work done at the rate of one joule per second. (A joule is the practical metric unit of work.) One joule equals 10^{17} ergs (the basic unit of work). Power in an electrical circuit is equal to the product of voltage and current and is expressed by the formula:

$$P = EI$$

where P equals the power in watts, E the electromotive force in volts, and I the current in amperes.

Since, according to Ohm's law $E = IR$, this equation can also be written $P = I^2R$. Likewise, since $I = E/R$, the formula is also written $P = E^2/R$.

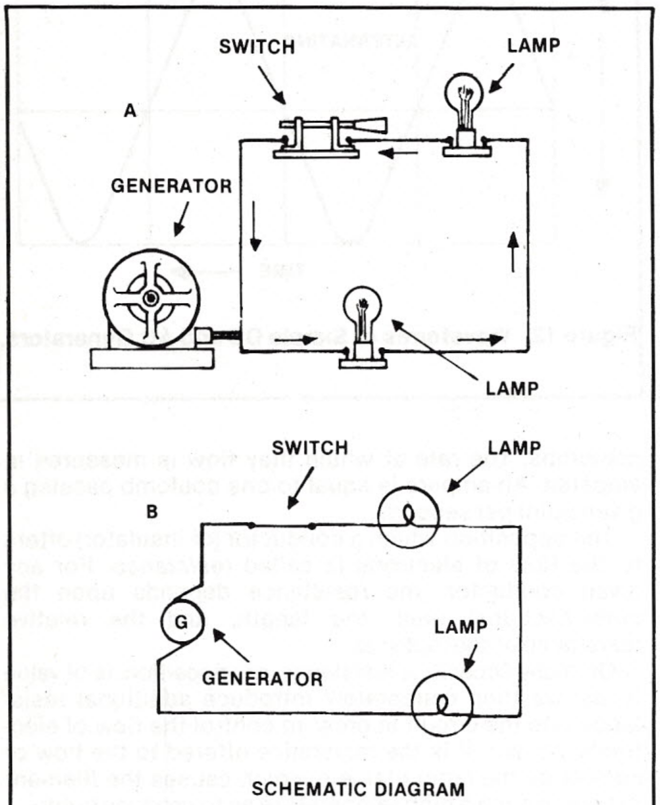


Figure 13. Series Electrical Circuit

SERIES CIRCUIT

In Figure 13 we have what is known as a series circuit. Here, a source of e.m.f. (generator), switch and two lamps are connected together so the current from the generator must flow through every part of the circuit in order to complete its path to the generator. The path is shown by the arrows.

Notice, particularly, that the same circuit flows through all parts of, a series circuit simultaneously. Therefore, if the filament of one lamp were to burn out, the circuit would be opened and no current would flow through any part of it, causing the other lamp to go out.

Characteristics of a Series Circuit:

1. The algebraic sum of the voltage drops including the source voltage is equal to zero.
2. Current is common to all circuit components.
3. Total Resistance $R_T = R_1 + R_2$

PARALLEL CIRCUIT

A parallel electrical circuit appears in Figure 14. In this case, a lamp, radio receiver, and a flatiron are all connected across the generator terminals. This arrangement of the circuit is such that switch #1 controls the lamp, switch #2 controls the radio, and switch #3 controls the flatiron.

If the lamp, radio or flatiron branch circuit should be interrupted, this will not prevent the current operation of the remaining units or appliances.

Thus, by comparing a series and a parallel circuit, we can state that in a series circuit all appliances in the circuit are dependent upon each other; whereas in the parallel circuit appliances are all independent of each other.

In Figure 14, current flows through the radio circuit only because switch #2 is the only one of the three switches which is closed.

A parallel electrical circuit can be compared to the parallel water circuit illustrated in Figure 14b. In this system, the pump draws water from the reservoir and, through a common header pipe, distributes this water to three faucets. These faucets are connected to the system so each faucet controls its own flow of water and is not dependent upon the operation of any of the other faucets. In this illustration, the faucets are connected in individual branch circuits, or connected in parallel.

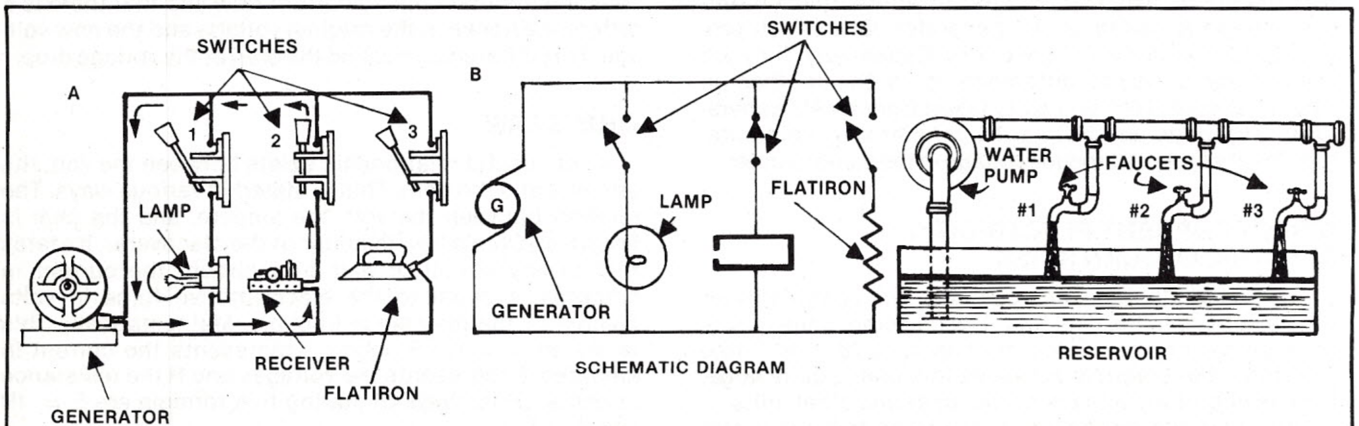
Characteristics of a Parallel Circuit

1. The algebraic sum of the individual branch currents including the total current is equal to zero.
2. The source voltage is common to all circuit branches.
3. Total resistance $R_T = \dfrac{R_1 R_2}{R_1 + R_2}$ or $R_T = \dfrac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$

ALTERNATING CURRENT (AC)

The output voltage of an AC generator can be expressed by a sine wave as shown in Figure 15.

During the time the coil in a generator rotates through 350, that is, one complete revolution, the output voltage goes through one complete cycle. During one cycle, the voltage increases from 0 to positive Em (E maximum) in



A Parallel Electrical Circuit

Figure 14.

B Circuit — Parallel Water

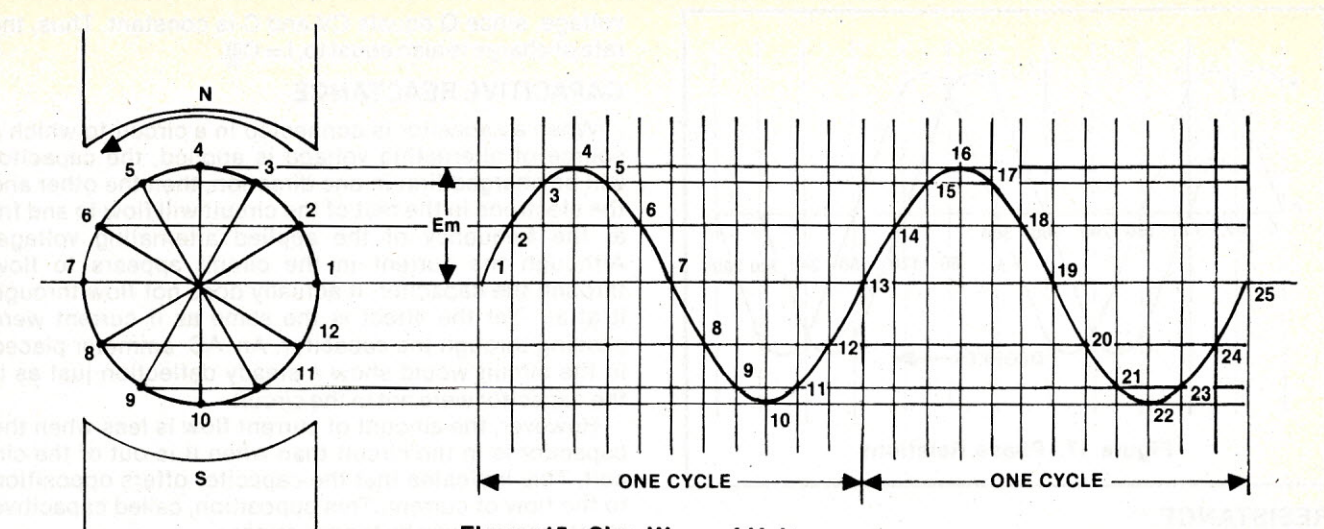


Figure 15. Sine Wave of Voltage

one direction, decreases to 0, increases in the opposite direction to negative Em, and then decreases to 0. The first 180° (one-half of the voltage cycle) is called positive alternation and the last 180°, from 180° to 360°, the negative alternation. The value of the Em voltage at 90° is called the amplitude or peak voltage. The time required for a positive and a negative alternation is called the period, and the number of complete cycles per second is called the frequency of the sine wave.

EFFECTIVE VALUE OF AC

Since a sine wave of AC current (or voltage) varies continually between zero and maximum (or peak) values, first in one direction, then the other, the question of numerical values arises. The value of AC most commonly used is effective value. The effective value of alternating current is the amount of alternating current which produces the same heating effect as an equal amount of direct current.

The RMS, or effective value of current, is commonly represented by I. Hence, the mathematical relation between effective and maximum (or peak values) of current can be expressed as $I = 0.707\ I_m$.

The relation between maximum (or peak) values of e.m.f. and effective e.m.f. is the same as the relation between peak and effective current. Thus $E = 0.707\ E_m$. The reciprocal of 0.707 is 1.414. Therefore, $E_m = 1.414\ E$ and $I_m = 1.414$ (see Figure 16).

AVERAGE VALUE OF AC

Another value in a sine wave sometimes used is the average value of the ordinates during the positive alternation. Average value is not as widely used as the RMS value, but in some instances is more a descriptive value of current or voltage. When an AC voltage is described by a value but is not designated RMS, peak or average, RMS value is meant.

PHASE

Phase is the fraction of a cycle that has elapsed since a voltage or a current has passed through a given value. Usually this value is the zero value. Referring to Figure 15 showing the sine wave of voltage and taking point 1 as the starting point or zero phase, note that the phase at point 2 is 30°, at point 3 it is 60°, at point 4 it is 90° and so on throughout one complete cycle until point 13, where the phase is 360° or 0°.

A term used more commonly than phase is phase difference. Phase difference can be used to describe two voltages having the same frequency which pass through zero values at different instants. The degrees along the axis indicate the phase of the voltage e_1 and e_2 at any instant. At the 0° position, e_2 equals 0. On the other hand, e_1 passes through the zero value at 120° and 300°, both of which are 60° ahead of e_2 in time. Thus the voltage e_1 is said to lead e_2 by 60° electrical degrees. Another way of saying this is that e_2 lags e_1 by 60° electrical degrees.

The concept of phase difference is also used to compare two different currents or a current and a voltage. The expression in phase means that the phase difference between two currents or a current and a voltage is zero degrees. Out of phase means that their phase difference is some amount other than zero.

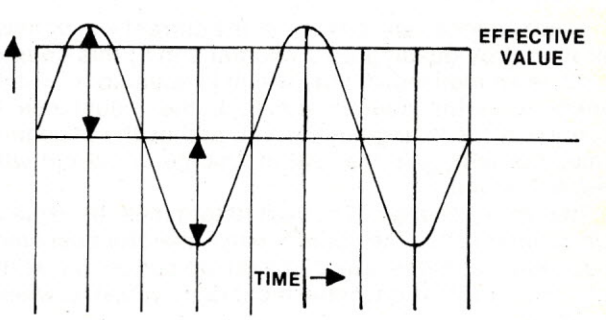


Figure 16. Determining Effective Value of Current

AC CIRCUIT COMPONENTS

Resistors are used to:
- Limit current.
- Produce a voltage drop.
- Dissipate heat.

Capacitors are used to:
- Store energy.
- Pass high frequencies and reject low frequencies.
- Produce an AC voltage drop.
- Introduce a time delay or phase difference.

Inductors also have applications in electrical circuits. They are used to:
- Store energy.
- Produce an AC voltage drop.
- Pass a low frequency and reject a high frequency.
- Introduce time delay or phase shift.

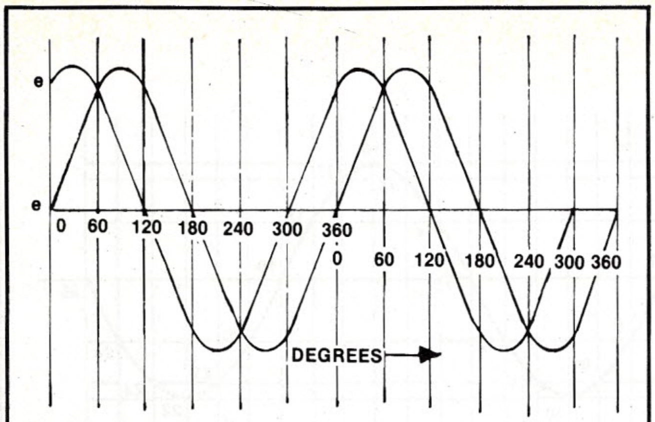


Figure 17. Phase Relations

RESISTANCE

Resistance is the property by which a conductor opposes the flow of current in it. In alternating current circuits, the resistance of a conductor opposes alternating current in the same way that it opposes direct current. In fact, except at extremely high frequencies, the DC resistance of a given conductor is the same as its AC resistance.

At ultra-high frequencies, current has a tendency to flow only on the surface of a conductor. This tendency is known as skin effect and causes the resistance of the conductor to increase. The higher the frequency, the more pronounced becomes skin effect. Because of it, many conductors of high frequency current in radar equipment are silver plated on the outside to reduce the resistance of the surface layer.

INDUCTANCE

A coil opposes any change in the current which flows through it by building up a counter e.m.f.; this counter e.m.f. is an induced voltage which is equal to $e_i = -L\frac{di}{dt}$, where e_i is the counter e.m.f., L the inductance in Henrys, di the change in current, and dt the change in time. The term $\frac{di}{dt}$ is the rate of change in current with respect to time.

The rate of change of current determines the value of the counter e.m.f. The counter e.m.f. therefore becomes maximum not at the time of maximum current but at the time the current is changing most rapidly, that is, when i is zero.

INDUCTIVE REACTANCE

Inductance in a circuit not only makes the current lag the voltage, but makes the magnitude of the current smaller. This choking down effect, which results from the opposition to current flow caused by the inductance, is known as inductive reactance and is given by the equation:

$$X_L = 2\pi fL$$

where X_L is the inductive reactance in ohms, "f" the frequency in cycles, and L the inductance in Henrys.

CAPACITANCE

Capacitance is thought of as that ability an electric circuit has to store energy. In a DC circuit, when a capacitor fully charges up, current ceases to flow. In AC, the charge on the capacitor opposes the applied voltage.

The value of i at any instant during the period of charge of a capacitor is the rate of charge and is equal to $i = \frac{dQ}{dt}$ where dQ equals the change in charge and dt the change in time.

The rate of change is C times the rate of change of voltage, since Q equals CV and C is constant. Thus, the rate of charge is also equal to, $i = C\frac{dv}{dt}$.

CAPACITIVE REACTANCE

When a capacitor is connected in a circuit to which a source of alternating voltage is applied, the capacitor will be charged first in one direction, then the other and the electrons in the rest of the circuit will flow to and fro at the frequency of the applied alternating voltage. Although the current in the circuit appears to flow through the capacitor, it actually does not flow through it at all. Yet the effect is the same as if current were passing through the capacitor. An AC ammeter placed in the circuit would show a steady deflection just as if the capacitor were not in the circuit.

However, the amount of current flow is less when the capacitor is in the circuit than when it is out of the circuit. This indicates that the capacitor offers opposition to the flow of current. This opposition, called capacitive reactance, is given by the equation:

$$X_c = \frac{1}{2fc}$$

Resonance:

A condition of resonance exists when $X_L = X_C$.

Resonance is expressed mathematically as: $Fr = \frac{1}{2\pi LC}$

Figure 18 shows an example of series resonance.

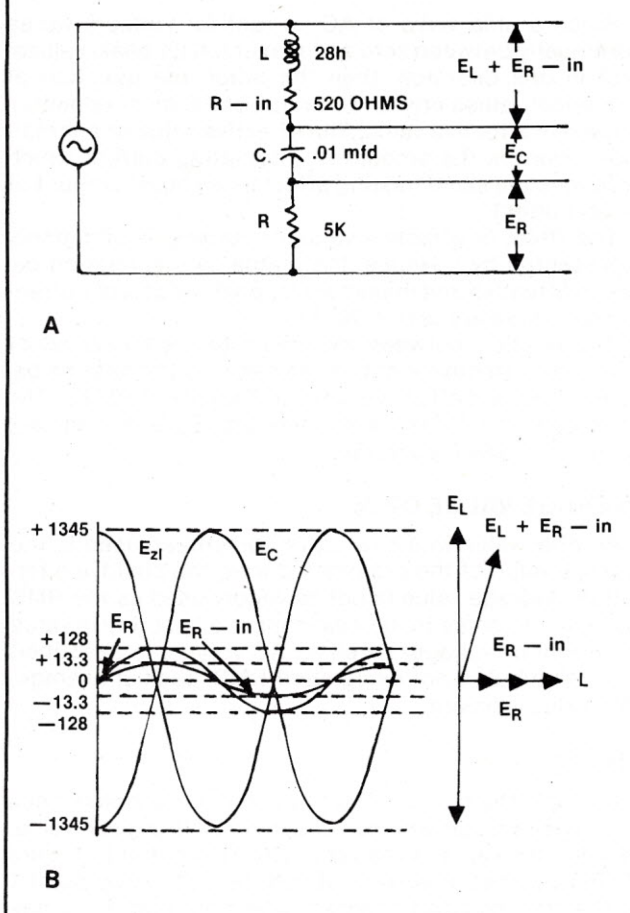


Figure 18.

In February: Unit I will conclude the introductory portion of this series and will include the answer card for this unit. □

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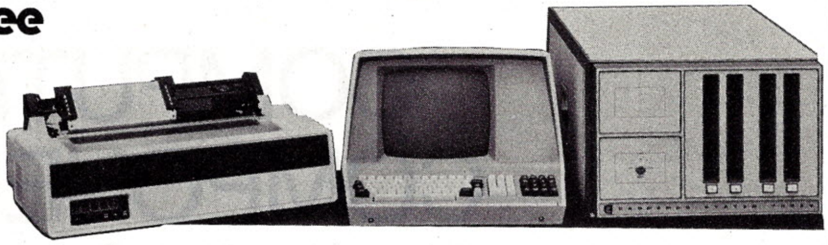

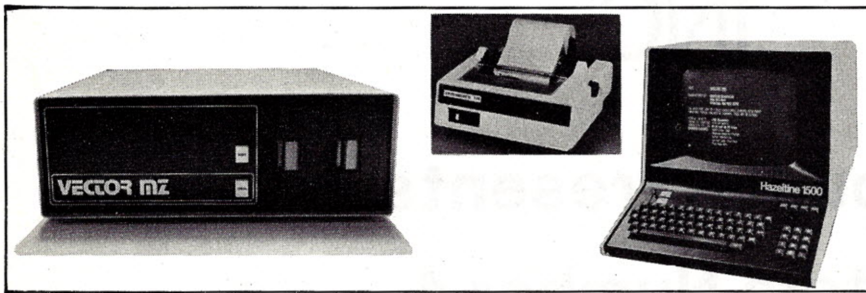

Vector MZ

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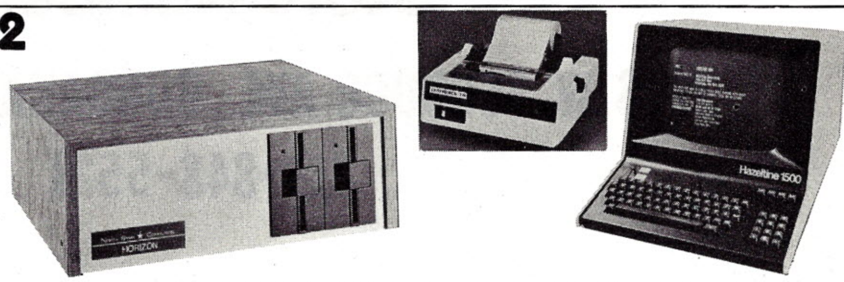

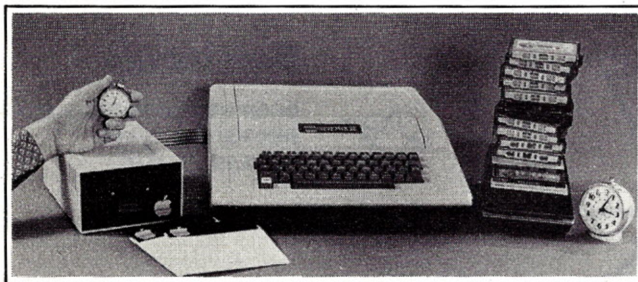

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3P + S + CIS – 30 +

By Gene Carleton

This article tells how I connected a Percom Data CIS-30+ Cassette Interface to the Processor Technology 3P+S I/O card in my Imsai 8080. My original system had a SWTP AC-30 cassette interface connected to the 3P+S. This arrangement was okay in the beginning, but soon I wanted a cassette interface that would allow a faster data rate than 300 baud. I noticed the CIS-30+ advertised cassette operation up to 1200 baud. The only problem was the ads always show the CIS-30+ used with SWTP 6800 systems. Since I had an Imsai 8080, I wondered what kind of problems I would really have. I finally decided that going from one 6800-oriented device, the AC-30, to another 6800-oriented device, the CIS-30+, couldn't be all that bad. Herein lies the story.

I was surprised how easily everything worked out. Assembly of the CIS-30+ was straightforward with no complications. One of my biggest problems was figuring out what CI, CO, RI, RO, etc., meant to my 3P+S. By referring to the schematic of the CIS-30+, I was able to determine the mnemonics of the interconnecting cable.

Modifying the 3P+S was so easy I was sure I had missed something. Here is all that needed to be done:

1. Cut one land on the 3P+S PCB (isolate the UART from the 3P+S clock). See Photo 2 for location. Figure 3 shows the schematic change.
2. Set the jumpers on the clock (area E) to put out 19.2KHz.

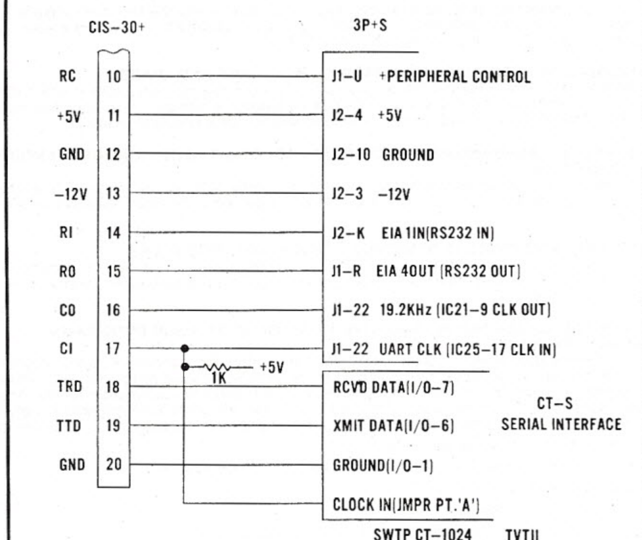


Figure 1. Interconnection Diagram

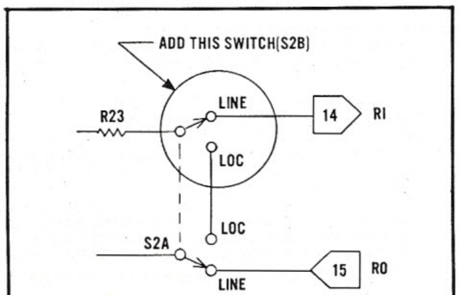


Figure 2. CIS-30+ Modification

3. Run wires from the edge connector to the following points: +5V, –12V, clock output (IC9-15), UART clock input (IC25-17).

Refer to Figure 4-2 in the 3P+S manual for all the jumpers normally on the I/O board in the RS232 configuration.

The RS232 input (EIA 1 IN) and output (EIA 4 OUT) signals are already on the 3P+S top connector. Photo 2 shows where the above changes were made. Figure 2 is an interconnection diagram showing the hookup between the 3P+S and the CIS-30+. I must point out here that having my status bits on part O (TBE-bit 7, RDA-bit 6) eliminated a lot of hardware and software changes. The peripheral driver output (from the 3P+S) is already connected to the correct bit so all output instructions automatically switch the CIS-30+ to the record mode. I put R10 to the left pad in area F on the 3P+S. Note in Photo 3 little attention was paid to layout or cabling of the signal wires.

All that remained was to get the RS232 input and output signals to the TVT. These signals originally passed through the AC-30 and had to be reconnected to the CIS-30+.

I also fed the "Clock In" signal from the CIS-30+ to the TVT. The rate switch on the CIS-30+ now determines the baud rate of the TVT as well as the 3P+S. This was a nice addition because it is hard to read scrolling text at 1200 baud. Switching the entire system to a slower rate when necessary with a single switch is quite a convenience.

In the LOCAL mode, the CIS-30+ still feeds data (RI) to the computer. This was a problem to me since I couldn't put headers on tapes in the local mode without sometimes locking the computer up in a load or verify mode. A simple mod to the CIS-30+ corrects this situation if it is a problem in your computer. Figure 2 shows

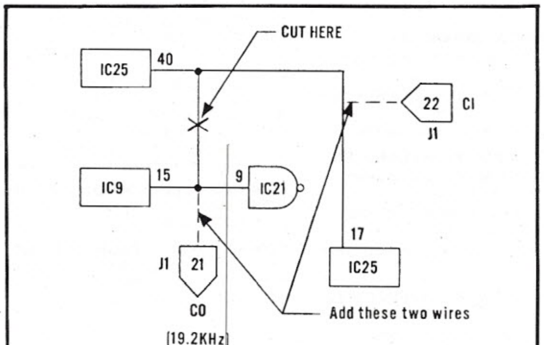
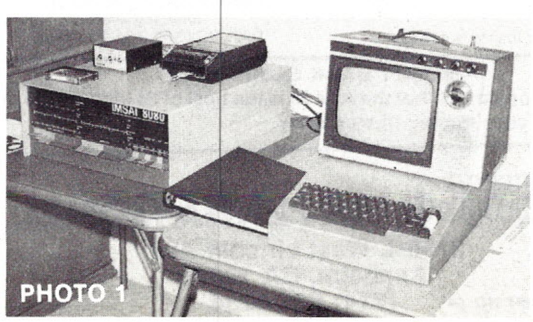


Figure 3. Isolation of UART from 3P+ Clock.



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AIM 65 Technical Overview

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- Versatile 5 x 7 dot matrix format
- Complete 64-character ASCII alphanumeric format
- Fast 120 lines per minute
- Quiet thermal operation
- Proven reliability

FULL-SIZE ALPHANUMERIC KEYBOARD
Provides compatibility with system terminals . . .
- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 9 control functions
- 3 user-defined functions

TRUE ALPHANUMERIC DISPLAY
Provides legible and lengthy display . . .
- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format

PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES
Reliable, high performance NMOS technology . . .
- R6502 Central Processing Unit (CPU), operating at 1 MHz.
Has 65K address capability, 13 addressing modes and true index capability. Simple, but powerful 56 instructions.
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 8K Monitor Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2532 PROM devices, to expand on-board Program Memory up to 20K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination device. Multipurpose circuit for AIM 65 Monitor functions.
- Two R6522 Versatile Interface Adapter (VIA) devices, which support AIM 65 and user functions. Each VIA has two parallel and one serial 8-bit, bidirectional I/O ports, two 2-bit peripheral handshake control lines and two fully-programmable 16-bit interval timer/event counters.

BUILT-IN EXPANSION CAPABILITY
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Standard interface to low-cost peripherals . . .
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ADVANCED INTERFACE MONITOR COMMANDS

Major Function Entry
(RESET Button)—Enter and initialize Monitor
ESC—Re-enter Monitor
E —Enter and initialize Text Editor
T —Re-enter Text Editor
N —Enter Assembler
5 —Enter and initialize BASIC Interpreter
6 —Re-enter BASIC Interpreter

Instruction Entry and Disassembly
I —Enter mnemonic instruction entry mode
K —Disassemble memory

Display/Alter Registers and Memory
* —Alter Program Counter to (address)
A —Alter Accumulator to (byte)
X —Alter X Register to (byte)
Y —Alter Y Register to (byte)
P —Alter Processor Status to (byte)
S —Alter Stack Pointer to (byte)
R —Display all registers
M —Displays four memory locations, starting at (address)
(SPACE)—Display next four memory locations
/ —Alter current memory location

Manipulate Breakpoints
—Clear all breakpoints
4 —Toggle breakpoint enable on/off
B —Set one to four breakpoint addresses
? —Display breakpoint addresses

Control Instruction/Trace
G —Execute user's program
Z —Toggle instruction trace mode on/off
V —Toggle register trace mode on/off
H —Trace Program Counter history

Control Peripheral Devices
L —Load object code into memory from peripheral I/O device
D —Dump object code to peripheral I/O device
1 —Toggle Tape 1 control on/off
2 —Toggle Tape 2 control on/off
3 —Verify tape checksum
CTRL PRINT—Toggle Printer on/off
LF —Line Feed
PRINT—Print Display contents

Call User-Defined Functions
F1 —Call User Function 1
F2 —Call User Function 2
F3 —Call User Function 3

Text Editor Commands
R —Read lines into text buffer from peripheral I/O device
I —Insert line into text buffer from Keyboard
K —Delete current line of text
(SPACE)—Display current line of text
L —List lines of text to peripheral I/O device
U —Move up one line
D —Move down one line
T —Go to top line of text
B —Go to bottom line of text
F —Find character string
C —Change character string
Q —Quit Text Editor, return to Monitor

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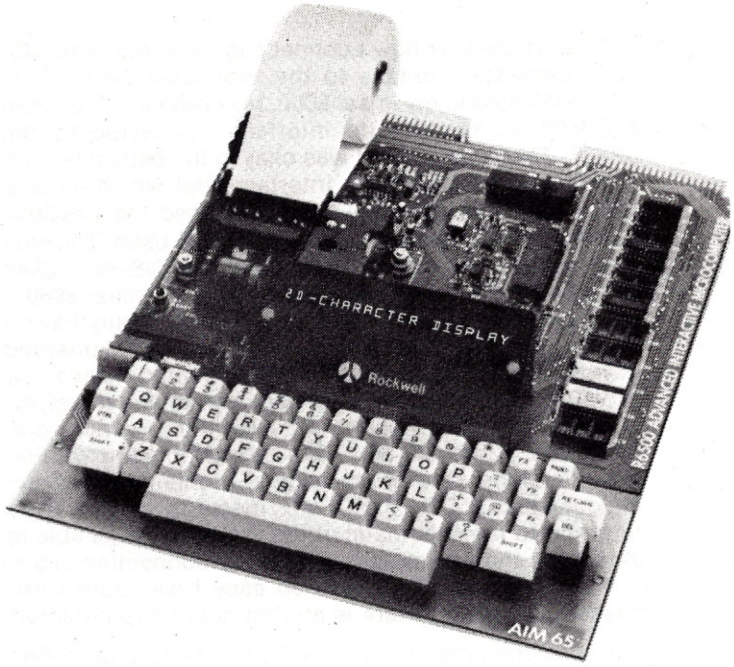

Rockwell's AIM 65 Advanced Interactive Microcomputer can get you into the exciting world of microcomputers a lot easier and at a lower cost than you may have thought possible. And you'll be working with the 6500 family, the advanced state-of-the-art NMOS system that's an everincreasing favorite for new commercial and hobbyist applications.

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You'll master fundamentals rapidly. Then you'll appreciate the fact that unlike the computer "toys" on the market, AIM 65 offers flexibility and expandability you would expect to find in a sophisticated microcomputer development system.

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AIM 65's 20-column Thermal Printer prints on low-cost, thermal roll paper at a fast 120 lines per minute. It produces all of the standard 64 ASCII characters with a crisp-printing five-by-seven dot matrix. AIM 65's on-board printer is a unique feature for a low-cost computer.

EXTENDED ALPHANUMERIC DISPLAY IS BUILT FOR UNDERSTANDING, NOT DECIPHERING.
AIM 65 comes with a 20-character true Alphanumeric Display. Information is displayed with bright, magnified 16-segment font monolithic characters. It's both unambiguous and easily readable.

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The AIM 65 Monitor includes commands to
- Enter and edit programs directly — no "opcode" memorization
- List programs on Printer or TTY
- Display/alter registers and memory
- Set breakpoints, trace and debug program execution
- Control the Thermal Printer
- Transfer information to/from attached Cassette Recorders or TTY
- Execute programs in on-board or external RAM, ROM or PROM memory
- Interface the optional AIM 65 Assembler and BASIC Interpreter

AIM 65'S ADVANCED R6500 NMOS ARCHITECTURE.
The R6502 Central Processing Unit is the heart of the AIM 65. It provides demonstrated speed and simplicity, plus 65K addressability and the power of a 56-command, minicomputer-like instruction set.

The R6532 RAM-Input/Output-Timer (RIOT) combination device is used by the AIM 65 Monitor for scratchpad memory and Keyboard operations.

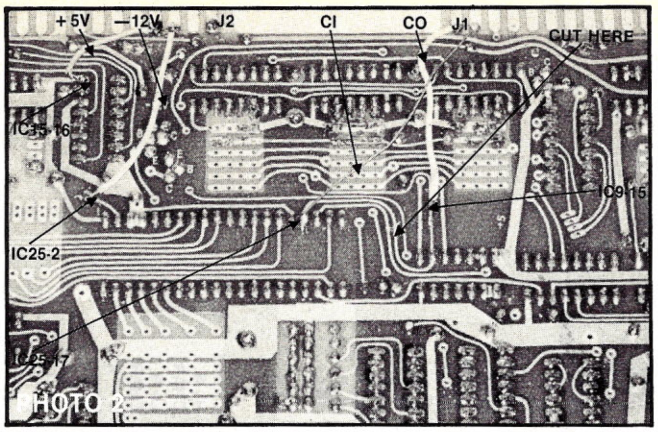
Two R6522 Versatile Interface Adapter (VIA) devices are provided. One device supports AIM 65's Thermal Printer and the TTY and Cassette Interfaces, the other supports two user-dedicated 8-line I/O ports, plus an 8-bit serial I/O port and access to two 16-bit interval timer/event counters, on the module's Application Connector.

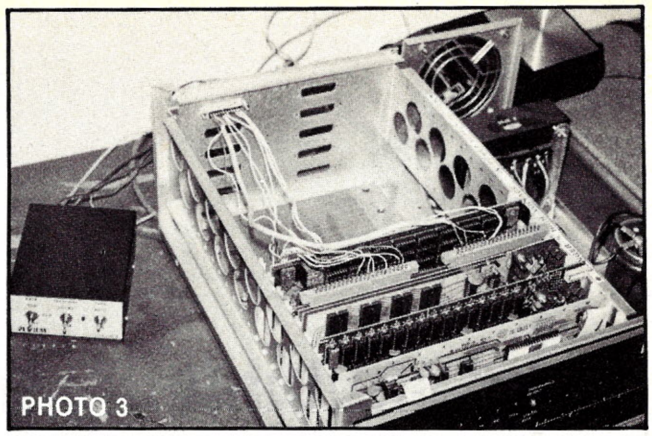
AIM 65 comes with two R2332 4K Read Only Memory (ROM) devices installed. These hold the Advanced Interface Monitor program. Spare sockets allow the user to expand on-board ROM up to 20K bytes. These sockets will accept user programs on R2332 ROMs or compatible PROMs, or can be used to install the optional AIM 65 Assembler and BASIC Interpreter ROM devices.

On-Board Read/Write RAM memory is available in 1K-byte and 4K-byte configurations.

AIM 65 HAS EXPANSION BUILT IN.
And to allow AIM 65 to grow the way **you** want it to, we've provided an Application Connector and an Expansion Connector. The Application Connector permits you to plug on a TTY (20 ma. current loop) and one or two standard audio cassette recorders. It also has the pinouts for the VIA's General-Purpose I/O ports. The Expansion Connector extends AIM 65's system bus — address, data and control — out to additional memory, or anything else you might attach.

And, BASIC high-level language programming is a built-in option.

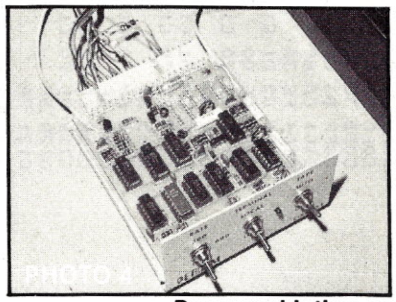




the changes I made to the CIS-30+. A DPDT switch was put in place of the SPDT TERMINAL switch. One pole was connected like the old switch. The other pole is used to route the signals as indicated in Figure 2.

The hard part was adjusting the CIS-30+. The first adjustment was no problem (setting the PLL). The only other adjustment stopped me cold. I needed an audio oscillator. I didn't have an audio oscillator. However, I learned I could get a cassette that had the frequencies I needed, or I could use an old cassette that had data recorded by the AC-30. I decided to use one of my old 300 baud tapes. Setting the trim pot at midrange, typing L on my TVT (see Program 1 for my monitor listing), I turned on the recorder. I got garbage. Undaunted, I turned the pot first one way and when the pot was turned about 20° off center the other way, data started to appear on the screen. I then checked all three data rates. The data loaded correctly the first time and I verified it five times with NO ERRORS.

COMMENT: Making the change from an AC-30 to the CIS-30+ did several things for my system. First, the maze of wires was cleaned up. There is a "clean" look to my installation now. Secondly, I am impressed with the "solid" CIS-30+. I have probably loaded or verified 40 or more tapes on my Imsai and have yet to lose a bit. Most of the tapes contain about 6K bytes of data. I use a standard G.E. cassette recorder ($45) in my system.□



Program Listing on next page

PROGRAM LISTING

```
C000                 *      PERCOM8080 MONITOR
C000 C3 03 C0               JMP    STRT PHANTOM JUMP
C003 DB 01           STRT   IN     1 CLEAR UART RECEIVE
C005 31 00 00               LXI    M,0 SET STK PTR
C008 CD 0E C0               CALL   MON
C00B C3 03 C0               JMP    STRT
C00E AF              MON    XRA    A SELECT TERMINAL
C00F D3 00                  OUT    0
C011 CD D2 C1               CALL   CRLF
C014 3E 3F                  MVI    A,'?'
C016 CD C3 C1               CALL   TTYO
C019 CD 8F C1               CALL   CIN GET COMMAND CHAR
C01C F5                     PUSH   M
C01D CD C1 C1               CALL   SPCE
C020 F1                     POP    M
C021 FE 44                  CPI    'D'
C023 CA 91 C0               JZ     DUMP
C026 FE 4E                  CPI    'N'
C028 CA 8D C0               JZ     NXT EXMN NXT LOC
C02B FE 4C                  CPI    'L'
C02D CA FC C0               JZ     LOAD LOAD PROGRAM
C030 FE 56                  CPI    'V'
C032 CA FC C0               JZ     LOAD VERIFY LOAD
C035 FE 4D                  CPI    'M'
C037 CA 46 C0               JZ     MEM EXAMINE MEMORY
C03A FE 43                  CPI    'C'
C03C CA 67 C0               JZ     CNG CHANGE MEMORY
C03F FE 47                  CPI    'G'
C041 C0                     RNZ
C042 CD C4 C0               CALL   AHEX
C045 E9                     PCHL
C046                 *      MEMORYDISPLAY
C046 CD D9 C0        MEM    CALL   SETUP GET START/FIN
C049 CD EB C0        M1     CALL   LNTH CALCULATE LEN
C04C AF                     XRA    A
C04D B8                     CMP    B
C04E C8                     RZ     QUIT IF ZERO
C04F CD 49 C1               CALL   ADD OUTPUT ADDRESS
C052 CD C1 C1               CALL   SPCE SPACE
C055 CD C1 C1        M2     CALL   SPCE SPACE
C058 7E                     MOV    A,M GET DATA
C059 CD 9D C1               CALL   HEXOUT CONVERT
C05C 23                     INX    H BUMP MEM ADDRESS
C05D 05                     DCR    B DECREMENT BYTE
C05E C2 55 C0               JNZ    M2 DONE? DOIT AGAIN
C061 CD D2 C1               CALL   CRLF
C064 C3 49 C0               JMP    M1 NEXT LINE
C067                 *      CHANGEMEMORY
C067 2B              CNG    DCX    H POSITION MEM ADD
C068 06 10           C1     MVI    B,10H SET UP BYTE CN
C06A CD D2 C1               CALL   CRLF
C06D CD 49 C1               CALL   ADD OUTPUT ADDRESS
C070 CD C1 C1               CALL   SPCE DOUBLE SPCE
C073 CD C1 C1               CALL   SPCE
C076 EB              C2     XCHG
C077 CD C4 C0               CALL   AHEX GET NEW DATA
C07A EB                     XCHG
C07B FE 2F                  CPI    '/' SLASH MEANS ABOR
C07D CA 68 C0               JZ     C1
C080 73                     MOV    M,E
```

```
C0F7 47              L1     MOV    B,A
C0F8 C9                     RET
C0F9                 *      CASSETTE CHECKSUM LOADER
C0F9 31 00 00               LXI    M,0
C0FC 57              LOAD   MOV    D,A
C0FD 3E 01                  MVI    A,01H
C0FF D3 00                  OUT    0
C101 CD 8F C1        READ   CALL   CIN
C104 FE 3A                  CPI    ':'
C106 C2 01 C1               JNZ    READ
C109 0E 00                  MVI    C,0
C10B CD 70 C1               CALL   CHAR
C10E 47                     MOV    B,A
C10F CA 51 C1               JZ     HXND
C112 CD 70 C1               CALL   CHAR
C115 67                     MOV    H,A
C116 CD 70 C1               CALL   CHAR
C119 6F                     MOV    L,A
C11A CD 70 C1               CALL   CHAR
C11D CD 70 C1        LOOP   CALL   CHAR
C120 5F                     MOV    E,A
C121 7A                     MOV    A,D
C122 FE 56                  CPI    'V'
C124 7B                     MOV    A,E
C125 CA F7 C0               JZ     L1
C128 77                     MOV    M,A
C129 BE              L1     CMP    M
C12A 1E 4D                  MVI    E,'M'
C12C C2 3C C1               JNZ    ERR
C12F 23                     INX    H
C130 05                     DCR    B
C131 C2 1D C1               JNZ    LOOP
C134 CD 70 C1               CALL   CHAR
C137 1E 58                  MVI    E,'X'
C139 CA 01 C1               JZ     READ
C13C                 *      ERROR PRINTOUT
C13C AF              ERR    XRA    A
C13D D3 00                  OUT    0
C13F CD D2 C1               CALL   CRLF
C142 7B                     MOV    A,E
C143 CD C3 C1               CALL   TTYO
C146 CD C1 C1               CALL   SPCE
C149 7C              ADD    MOV    A,H
C14A CD 9D C1               CALL   HEXOUT
C14D 7D                     MOV    A,L
C14E C3 9D C1               JMP    HEXOUT
C151 7A              HXND   MOV    A,D
C152 FE 52                  CPI    'R'
C154 C8                     RZ
C155 CD 8F C1               CALL   CIN
C158 FE 0D                  CPI    0DH
C15A C8                     RZ
C15B CD 73 C1               CALL   CHAR1
C15E 67                     MOV    H,A
C15F CD 70 C1               CALL   CHAR
C162 6F                     MOV    L,A
C163 CD 70 C1               CALL   CHAR
C166 1E 58                  MVI    E,'X'
C168 C2 3C C1               JNZ    ERR
C16B AF                     XRA    A
C16C D3 00                  OUT    0
C16E F1                     POP    M
C16F E9                     PCHL
```

```
C081 23               INX    H BUMP MEM ADD
C082 5D               MOV    E,L
C083 FE 0D            CPI    0DH CHECK FOR CR
C085 C8               RZ     QUIT IF CR
C086 05               DCR    B DECREMENT BYTE COU
C087 C2 76 C0         JNZ    C2 NOT ZERO? GET ANO
C08A C3 68 C0         JMP    C1 STRT NEW LINE
C08D 13         NXT   INX    D
C08E C3 49 C0         JMP    M1
C091            *     CHECKSUM DUMP PROGRAM
C091 CD D9 C0   DUMP  CALL   SETUP GET STRT/FIN
C094 3E 02            MVI    A,02H TURN CASSETTE
C096 D3 00            OUT    0
C098 CD D2 C1   D1    CALL   CRLF
C09B 0E 00            MVI    C,0 CLEAR CHECKSUM
C09D 3E 3A            MVI    A,':' GET BLOCK HEAD
C09F CD C3 C1         CALL   TTYO OUTPUT
C0A2 CD EB C0         CALL   LNTH CALCULATE BLOCK
C0A5 78               MOV    A,B
C0A6 CD 9D C1         CALL   HEXOUT
C0A9 CA D2 C1         JZ     CRLF
C0AC CD 49 C1         CALL   ADD
C0AF AF               XRA    A
C0B0 CD 9D C1         CALL   HEXOUT OUTPUT BLOCK
C0B3 7E         D2    MOV    A,M GET DATA
C0B4 CD 9D C1         CALL   HEXOUT
C0B7 23               INX    H
C0B8 05               DCR    B
C0B9 C2 B3 C0         JNZ    D2
C0BC AF               XRA    A
C0BD 91               SUB    C
C0BE CD 9D C1         CALL   HEXOUT OUTPUT CHECKS
C0C1 C3 98 C0         JMP    D1
C0C4            *     INPUT ASCII-CONVERT TO BIN
C0C4 21 00 00   AHEX  LXI    H,0 CLEAR H & L
C0C7 CD 8F C1   A1    CALL   CIN INPUT A CHARACTE
C0CA FE 30            CPI    '0' RETURN IF ASCII
C0CC D8               RC
C0CD 29               DAD    H
C0CE 29               DAD    H
C0CF 29               DAD    H
C0D0 29               DAD    H
C0D1 CD 87 C1         CALL   HEX CONVERT CHAR TO
C0D4 85               ADD    L COMBINE PREVIOUS
C0D5 6F               MOV    L,A RESULT
C0D6 C3 C7 C0         JMP    A1 DO AGAIN
C0D9 CD C4 C0   SETUP CALL   AHEX GET STRT ADD
C0DC 5D               MOV    E,L SAVE IN D & E
C0DD 54               MOV    D,H
C0DE FE 0D            CPI    0DH CHEKC FOR CR
C0E0 CA E7 C0         JZ     S1 RETRN IF CR
C0E3 CD C4 C0         CALL   AHEX GET FIN ADD
C0E6 EB               XCHG
C0E7 13         S1    INX    D ADJUST FIN ADD
C0E8 C3 D2 C1         JMP    CRLF RETURN VIA CRLF
C0EB            *     CALCULATE BLOCK LENGTH
C0EB 7B         LNTH  MOV    A,E
C0EC 95               SUB    L
C0ED 47               MOV    B,A
C0EE 7A               MOV    A,D
C0EF 9C               SBB    H
C0F0 3E 10            MVI    A,10H
C0F2 C2 F7 C0         JNZ    L1
C0F5 B8               CMP    B
C0F6 D0               RNC
```

```
C170                  *      GET    2 CHAR & CONVERT TO
C170 CD 8F C1         CHAR   CALL   CIN
C173 CD 87 C1         CHAR1  CALL   HEX
C176 07                      RLC
C177 17                      RAL
C178 17                      RAL
C179 17                      RAL
C17A 5F                      MOV    E,A
C17B CD 8F C1                CALL   CIN
C17E CD 87 C1                CALL   HEX
C181 83                      ADD    E
C182 5F                      MOV    E,A
C183 81                      ADD    C
C184 4F                      MOV    C,A
C185 7B                      MOV    A,E
C186 C9                      RET
C187 D6 30            HEX    SUI    30H
C189 FE 0A                   CPI    0AH
C18B D8                      RC
C18C D6 07                   SUI    07H
C18E C9                      RET
C18F DB 00            CIN    IN     0
C191 E6 40                   ANI    40H
C193 CA 8F C1                JZ     CIN
C196 DB 01                   IN     1
C198 D3 01                   OUT    1
C19A E6 7F                   ANI    7FH
C19C C9                      RET
C19D                  *      CONVERT BYTE TO 2 ASCII
C19D F5               HEXOUT PUSH   M
C19E 0F                      RRC
C19F 0F                      RRC
C1A0 0F                      RRC
C1A1 0F                      RRC
C1A2 CD AE C1                CALL   HEXO
C1A5 F1                      POP    M
C1A6 F5                      PUSH   M
C1A7 CD AE C1                CALL   HEXO
C1AA F1                      POP    M
C1AB 81                      ADD    C
C1AC 4F                      MOV    C,A
C1AD C9                      RET
C1AE E6 0F            HEXO   ANI    0FH
C1B0 C6 30                   ADI    30H
C1B2 FE 3A                   CPI    3AH
C1B4 DA C3 C1                JC     TTYO
C1B7 C6 07                   ADI    07H
C1B9 C3 C3 C1                JMP    TTYO
C1BC C6 07                   ADI    07H
C1BE C3 C3 C1                JMP    TTYO
C1C1 3E 20            SPCE   MVI    A,20H
C1C3 F5               TTYO   PUSH   M
C1C4 DB 00            T1     IN     0
C1C6 07                      RLC
C1C7 D2 C4 C1                JNC    T1
C1CA 07                      RLC    NOP.
C1CB DA 03 C0                JC     STRT
C1CE F1                      POP    M
C1CF D3 01                   OUT    1
C1D1 C9                      RET
C1D2 3E 0D            CRLF   MVI    A,0DH
C1D4 CD C3 C1                CALL   TTYO
C1D7 3E 0A                   MVI    A,0AH
C1D9 CD C3 C1                CALL   TTYO
C1DC AF                      XRA    A
C1DD C3 C3 C1                JMP    TTYO
```

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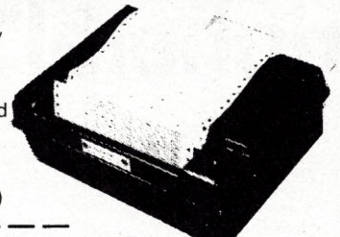

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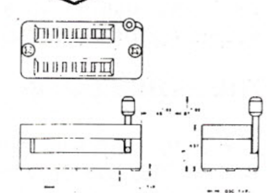

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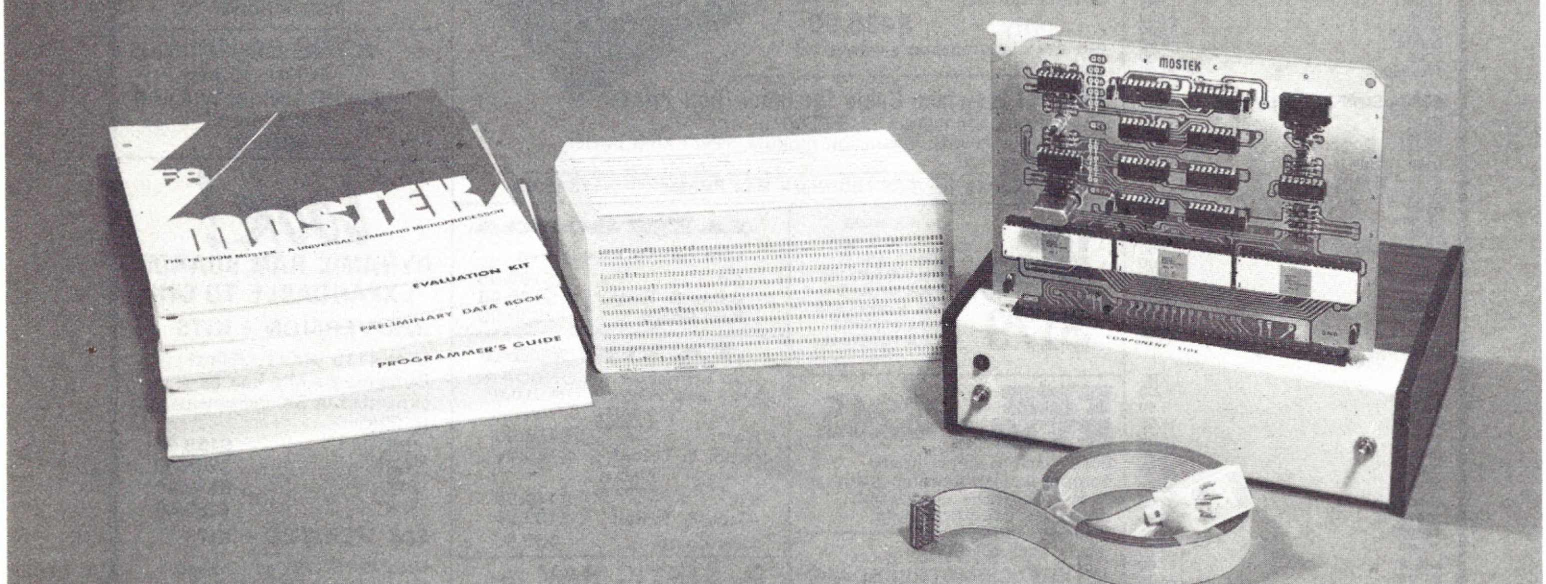
CIRCLE INQUIRY NO. 80

The F8 Finds A Home As A Peripheral Processor



By Russell Fish III
System Insights

With hobbyists beginning to add on more peripherals, the main microcomputer is becoming overworked with Input/Output, and the cost of peripheral interfaces is becoming significant. Large computers have used minicomputers as peripheral processors for over a decade. Now, the availability of low cost microcomputers like the F8 allows the hobbyist to reduce peripheral interfacing cost and greatly improve system speed by shifting software from the main microcomputer and hardware from the interface into a peripheral processor.

The F8 microprocessor system was announced about the same time as the 6800 and 8080. Even though the F8 family parts were well designed and easy to manufacture, the F8 family maintained a very low profile for several years. The reason for the slow start was its unusual design. The F8 designers found that most microprocessors were being used in time related and control environments (turning things on and off) rather than in data processing (manipulating large memories or doing lots of math) environments. They also found that most microprocessor systems were very small and used minimum amounts of memory but large amounts of Input/Output. The F8 was designed with these ideas in mind. The resulting F8 system was very strong in three areas:

Input/Output handling
Time controlled operations
Multiple precision memory manipulation

Tradeoffs were made which reduced the F8 power in areas of mathematics such as binary multiplication. The manipulation of large blocks of memory was also limited somewhat. Through clever design, the F8 didn't need an address bus, so Input/Output ports could now be put on the 40-pin Central Processing Unit (CPU).

The F8 system was designed so that with two chips, a designer could have 32 lines of bidirectional Input/Output, 64 bytes of Random Access Memory, 1K bytes of ROM, a timer, and interrupt logic. For high performance, low cost microprocessor applications, the F8 was difficult to beat. The early F8 users who succeeded in overcoming the educational problem of designing with the new architecture had very successful designs. In the last year, applications engineers have become more sophisticated, and the F8 has been rapidly finding more and more users. As a result, the F8 is very close to becoming the largest selling microprocessor family.

THE F8 BUS-BOYS

Figure 1 shows members of the F8 microcomputer family. The top drawing shows the expandable version of the F8 system. The two major components are the Central Processing Unit (CPU) and the Program Storage Unit (PSU). The CPU contains the Arithmetic Logic Unit which performs the mathematical and logical functions, the decode logic for the 70+ instructions, and a 64-byte Random Access Memory. Because there is no address bus, two 8-bit Input/Output ports are also on the CPU.

Other chips in the F8 family connect to the 8-bit data bus and control lines. An easy way to add Read Only Memory is with a Program Storage Unit (PSU). Each PSU contains 1K bytes of ROM, a timer, and interrupt logic. Because the PSU talks to the CPU over an 8-bit data bus, there are 16 lines available on the 40-pin PSU package for two 8-bit bidirectional Input/Output ports. For systems that require external Random Access Memory, a Static Memory Interface (SMI) chip can be used. The SMI chip generates a 16-bit address bus from the F8 control and data lines so that up to 64K bytes of memory can be

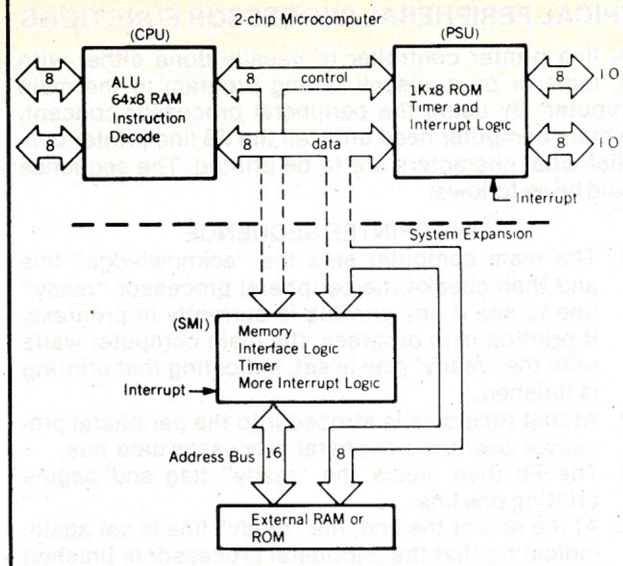


Figure 1. Expandable F8 System

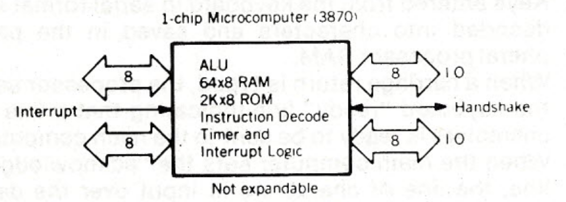


Figure 2. Single Chip F8

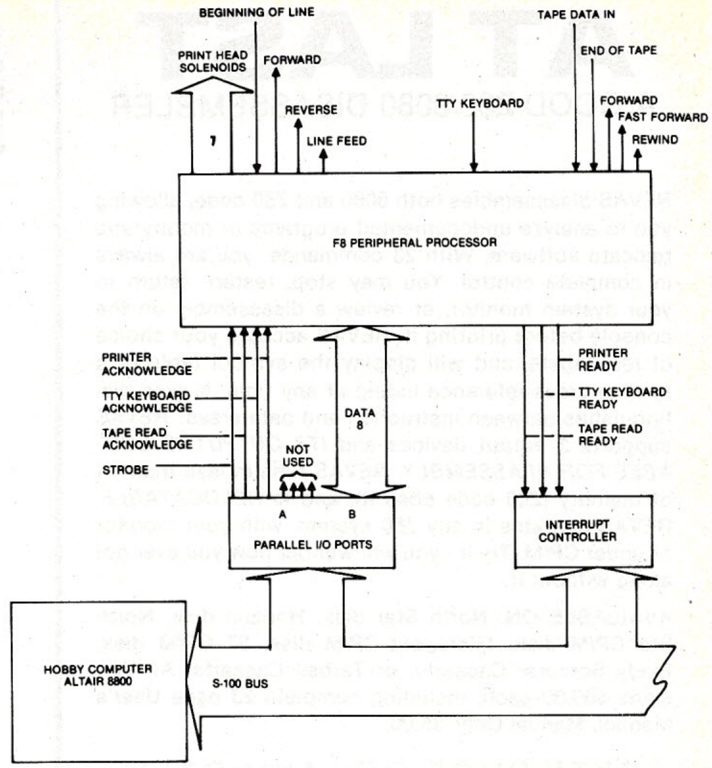


Figure 3. Hobby Computer and Peripheral Controller.

addressed. In addition to generating an address bus, an SMI contains another timer and more interrupt logic.

Figure 2 shows a new member of the F8 family, which combines the two chip F8 system onto a single chip. The 3870 single chip microcomputer was designed to implement high volume, low cost consumer and industrial control applications. Because of new Read Only Memory technology, the 3870 is able to contain 2K bytes of ROM instead of the normal 1K byte found on the PSU. Because there are no data or control lines out of the 3870, it is not expandable.

UNLOADING THE DONKEY WORK

Industrial users favor the F8 for applications where low cost is important. Hobbyists, however, are making use of the F8 as a peripheral processor for the main microcomputer. A peripheral processor does Input/Output work for the main microcomputer. Input/Output and timing control are two of the most inefficient operations for a computer to do. By delegating these inefficient functions to a peripheral processor, the performance of the main microcomputer is drastically increased, and interfacing costs are reduced.

Figure 3 shows an example of a peripheral processor functioning with a typical hobby computer. Notice how software from the main microcomputer and hardware from the normal interface circuitry is replaced by the peripheral processor. A typical peripheral processor might control simultaneously a Teletype, a tape drive, a floppy disk, and the real time clock circuitry. Control of any of these functions could be implemented in normal digital logic, but because of the low cost of the F8, a high performance peripheral controller for several devices can be created very efficiently. In a system where several peripheral devices are controlled simultaneously, the F8 would probably use a "Real Time Scheduler" program so that programs for each peripheral device can appear to run simultaneously.

An example of a typical scheduler for the F8 is MITOS, described in the book *Microprocessors in Systems.* MITOS is able to run up to 50 simultaneously running programs. Several examples should indicate how the F8 based peripheral controller can unload the main microcomputer from the drudgery of Input/Output control.

GIVE THE COMPUTER A HAND

Communications between the main microcomputer and the peripheral processor is done over an 8-bit data bus with strobe, "ready" lines, and "acknowledge" lines shown in Figure 3. Data such as characters received from a keyboard or sent to a line printer goes over the 8-bit bus. The strobe line is bidirectional and tells the receiving party when the 8 data bits are present. The "ready" line tells the main microcomputer that the peripheral processor is ready to do something, for example, ready to send data from a keyboard or accept data for a printer. The "acknowledge" line tells the peripheral processor that the main microcomputer is ready to do something. "Ready" and "acknowledge" are required since either the main computer or the peripheral processor may be busy and take some time to prepare to transfer data. The "acknowledge" and "ready" lines perform identical functions, except one comes from the main computer and the other comes from the peripheral processor. Together they perform "handshaking". When both "acknowledge" and "ready" lines are set, data transfer takes place.

TYPICAL PERIPHERAL PROCESSOR FUNCTIONS

A line printer controller is usually done either with TTL logic or by a special timing program in the main computer. By using the peripheral processor concept, the main computer need only tell the F8 line printer controller what characters are to be printed. The sequence would be as follows:

LINE PRINTER SEQUENCE

1. The main computer sets the "acknowledge" line and then checks the peripheral processor "ready" line to see if any printing is currently in progress. If printing is in progress, the main computer waits until the "ready" line is set, indicating that printing is finished.
2. At that time data is strobed into the peripheral processor over the peripheral processor data bus.
3. The F8 then clears the "ready" flag and begins printing one line.
4. At the end of the line, the "ready" line is set again, indicating that the peripheral processor is finished with the present line and ready to accept the next line from the main computer.

SERIAL KEYBOARD INPUT SEQUENCE (TTY)

1. Keys entered from the keyboard in serial format are decoded into characters and saved in the peripheral processor RAM.
2. When a carriage return is typed, the processor sets the keyboard "ready" line indicating that a line of characters is ready to be sent to the main computer.
3. When the main computer sets the "acknowledge" line, the line of characters is input over the data bus to the main computer.
4. After the transfer is complete, the peripheral processor "ready" line is reset until another line of characters is ready.

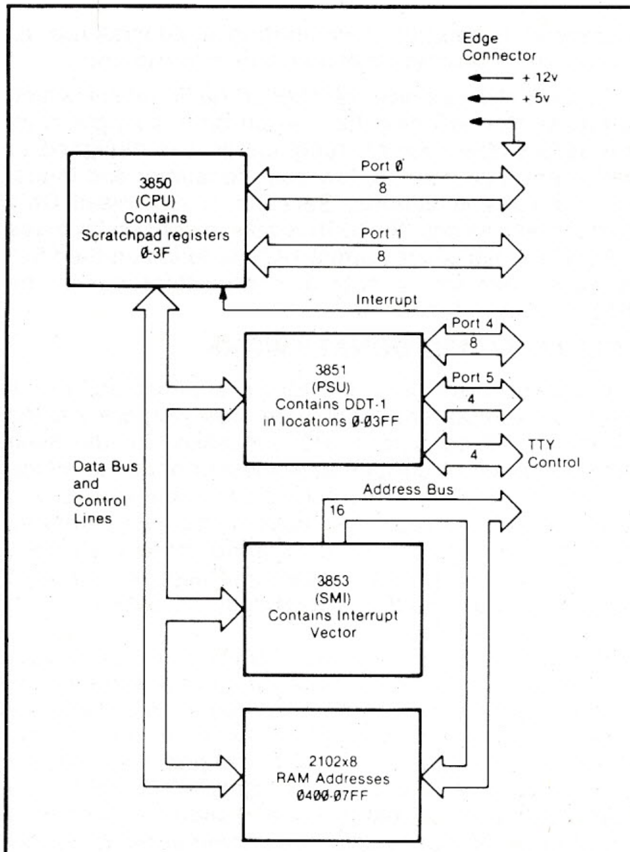


Figure 4. Evaluation Kit Block Diagram

TAPE DRIVE READ SEQUENCE

1. The main computer sets the "acknowledge" line to get the peripheral processor's attention. When the "ready" line is set, indicating the processor is free, a tape location address is transmitted over the data lines from the computer.
2. The F8 peripheral processor then clears the "ready" line from the computer, the computer clears the "acknowledge" line and begins to search the tape for the particular location to read.
3. When the correct location is found, the data is read from the tape, and the peripheral processor sets the "ready" line, which will interrupt the main computer indicating that the tape read is complete.
4. When the main computer sets the "acknowledge" line, the tape data is transferred over the peripheral processor data bus to the main computer.

IMPLEMENTING THE INTERFACE

The peripheral processor communicates to the main computer through an Input/Output port and the interrupt logic. The 8-bit data bus from the peripheral processor connects directly to an Input/Output port, and each of the "ready" lines are connected to the interrupt prioritizing circuitry. The transfer strobe and the "acknowledge" lines are connected to an output port on the main computer also.

Some peripheral controllers are implemented with programs in ROM. The new single chip F8, the 3870, is very popular for this purpose. Home computer users who design their own peripheral control systems generally use the F8 Evaluation Kit and either load the programs into the on-board RAM or attach PROMs or EAROMs.

Command	Result
M XXXX	The contents of memory location XXXX are printed on the TTY and new contents can be entered if required.
P XX	The contents of port XX are printed on the TTY and new contents can be entered if required.
H XXXX + or − YYY =	The two hexadecimal values are either added or subtracted and the result is printed.
E XXXX	Program execution will begin at location XXXX.
B XXXX	A breakpoint is set in the user program at location XXXX. When the program executes to the breakpoint, internal registers are transferred to upper RAM locations 0FB0-0FFF for inspection, and program execution stops.
C XXXX,YYYY,ZZZZ	The contents of RAM from XXXX to YYYY are transferred into another RAM area whose first location is ZZZZ.
T XXXX,YYYY	The contents of RAM from XXXX to YYYY are printed on the TTY.
D XXXX,YYYY	The contents of RAM from XXXX to YYYY are output in a paper tape format.
L	A paper tape made with the D command is loaded into RAM.

Figure 5. DDT-1

EVALUATING THE EVALUATION KIT

The Evaluation Kit, seen in Photo 1, is a single board microcomputer made by Mostek to allow designers to easily learn how to program and interface with the F8 system. Figure 4 shows the block diagram of the Evaluation Kit. On the single board there is a microcomputer with memory and a program in Read Only Memory which allows a program to be written and executed from a terminal. Four lines control communications with a terminal at speeds of either 10 or 30 characters per second.

Including the Teletype control lines there are 32 lines of Input/Output. There is one interrupt line and one timer on the board. The timer is valuable for implementing the Real Time Scheduler program. Figure 5 shows the capabilities of the program known as DDT-1. DDT-1 allows programs to be entered from the Teletype to memory, breakpoints to be set, programs to be executed, programs to be dumped on paper tape, or programs to be loaded from paper tape. Because of its low cost (about $150), the Evaluation Kit is an excellent device for doing experimental designs with intelligent peripheral controllers for hobby computers.

THE HOBBY COMPUTER COMES OF AGE

The F8 microcomputer family was designed for efficient handling of Input/Output and timing control functions. Because of the very low cost of F8 systems, this family has received enthusiastic acceptance by many industry designers. However, as hobbyist hardware becomes more sophisticated, hobby computer designers are beginning to realize the power of using the F8 as a peripheral processor to unload time consuming Input/Output and control tasks from the main microcomputer.

There are three results of this trend to peripheral processors. First, there is a large reduction in the cost of interfacing to peripheral devices such as printers, tape drives, and floppy disks to the main microcomputer. Second, the performance of the peripheral devices can be improved through intelligent control by the peripheral processor. Third, throughput of the main microcomputer can be significantly increased by delegating the time consuming Input/Output and control functions. □

GLOSSARY OF TERMS

CPU — Central Processing Unit, the brain of a computer, does math logic, and decision functions.

HANDSHAKING — The exchange of signals that takes place between the computer and peripheral processor before data is exchanged between them.

PERIPHERAL PROCESSOR — A computer designed to unload the main computer from the control and timing work in talking to peripherals such as tape drives and printers.

PSU — Program Storage Unit, an F8 family device which contains Read Only Memory (ROM), Interrupt Logic, a programmable timer, and two 8-bit Input/Output ports.

REAL TIME SCHEDULER — A program which causes several other programs to appear to be executing simultaneously on one computer.

SMI — Static Memory Interface, an F8 family device which connects the Central Processing Unit to external memory chips.

SOFTWARE — Programs.

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7405	.21
7406	.25
7407	.25
7408	.21
7409	.21
7410	.17
7411	.21
7412	.21
7413	.25
7414	.89
7416	.25
7417	.25
7420	.21
7421	.25
7423	.35
7425	.35
7426	.25
7427	.33
7428	.28
7430	.21
7432	.25
7433	.30
7437	.25
7438	.25
7439	.50
7440	.21
7442	.53
7445	.70
7446	.70
7447	.70
7448	.70
7450	.21
7451	.21
7453	.21
7454	.21
7460	.21
7470	.30
7472	.30
7473	.30
7474	.30
7475	.49
7476	.32
7480	.70
7483	.70
7485	.89
7486	.28
7489	2.19
7490	.44
7491	.70
7492	.44
7493	.44
7494	.70
7495	.70
7496	.70
74100	1.28
74107	.30
74109	.33
74116	1.26
74121	.35
74122	.44
74123	.61
74125	.40
74126	.40
74128	.48
74132	.70
74141	.88
74145	.70
74147	1.63
74148	1.30
74150	1.16
74151	.70
74153	.65
74154	1.03
74155	.70
74156	.70
74157	.70
74160	.88
74161	.79
74162	.88
74163	.88
74164	.96
74165	1.15
74166	1.26
74170	2.64
74173	1.42
74174	.98
74175	.93
74176	.79
74177	.79
74180	.70
74181	2.15
74182	.79
74184	2.19
74185	2.19
74189	3.50
74190	1.23
74191	.95
74192	.88
74193	.88
74194	.88
74195	.88
74196	.88
74197	.88
74198	1.49
74199	1.49
74221	.86
74251	1.09
74279	.55
74298	.94
74365	.67
74366	.67
74367	.67
74368	.67

74LS00

74LS00	.28
74LS01	.28
74LS02	.28
74LS03	.28
74LS04	.29
74LS05	.29
74LS08	.29
74LS09	.29
74LS10	.28
74LS11	.28
74LS12	.28
74LS13	.47
74LS14	1.02
74LS15	.28
74LS20	.28
74LS21	.28
74LS22	.28
74LS26	.33
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74LS32	.33
74LS33	.33
74LS37	.33
74LS38	.33
74LS40	.28
74LS42	.67
74LS47	.79
74LS48	.77
74LS51	.28
74LS54	.28
74LS55	.28
74LS73	.39
74LS74	.39
74LS75	.53
74LS76	.39
74LS78	.39
74LS83	.79
74LS85	.98
74LS86	.39
74LS90	.57
74LS92	.57
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74LS95	.88
74LS96	.88
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74LS109	.39
74LS112	.39
74LS113	.39
74LS114	.39
74LS125	.49
74LS126	.49
74LS132	.81
74LS136	.39
74LS138	.73
74LS139	.73
74LS151	.75
74LS153	.75
74LS154	1.10
74LS155	.75
74LS156	.75
74LS157	.75
74LS158	.75
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74LS161	1.02
74LS162	1.02
74LS163	1.02
74LS164	1.02
74LS168	1.14
74LS169	1.14
74LS170	1.73
74LS173	1.34
74LS174	1.06
74LS175	.84
74LS181	2.50
74LS190	1.18
74LS191	1.18
74LS192	.98
74LS193	1.06
74LS194	.88
74LS195	.88
74LS196	.86
74LS197	.86
74LS240	1.90
74LS241	1.90
74LS242	1.70
74LS243	1.70
74LS244	1.70
74LS247	.79
74LS248	.79
74LS249	.79
74LS253	.84
74LS257	.75
74LS258	.75
74LS260	.34
74LS261	2.00
74LS266	.39
74LS273	1.28
74LS283	.79
74LS290	.65
74LS293	.65
74LS295	1.12
74LS298	1.30
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74LS368	.67
74LS377	1.50
74LS386	.39
74LS395	1.74
74LS670	2.34
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81LS96	.77
81LS97	.77
81LS98	.77

74C00

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74C08N	.25
74C10N	.25
74C14N	.90
74C20N	.25
74C30N	.25
74C32N	.25
74C42N	.98
74C48N	1.28
74C73N	.72
74C74N	.48
74C76N	.72
74C83N	1.38
74C85N	1.38
74C86N	.40
74C90N	.98
74C93N	.98
74C95N	1.10
74C107N	.70
74C150N	2.90
74C151N	1.90
74C154N	2.90
74C157N	1.90
74C160N	1.18
74C161N	1.18
74C162N	1.18
74C163N	1.18
74C164N	1.10
74C165N	1.10
74C173N	1.30
74C174N	1.16
74C175N	1.16
74C192N	1.38
74C193N	1.38
74C195N	1.10
74C221N	1.90
80C95N	.48
80C96N	.48
80C97N	.48
80C98N	.48
74C901N	.48
74C902N	.48
74C909N	1.78
74C926N	7.80

4000 CMOS

4000	.23
4001	.23
4002	.23
4006	1.23
4007	.23
4008	.79
4009	.44
4010	.44
4011	.23
4012	.23
4013	.40
4014	.96
4015	.96
4016	.40
4017	1.05
4018	1.05
4019	.40
4020	1.14
4021	1.14
4022	.96
4023	.23
4024	.84
4025	.23
4027	.40
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4033	1.51
4034	3.50
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4043	.70
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4081	.23
4082	.23
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4511	1.05
4514	2.80
4515	2.80
4516	1.23
4518	1.14
4520	1.14
4527	1.68
4528	.88

INTERFACE

8093	.40
8094	.40
8095	.67
8096	.67
8097	.67
8098	.67
75450	.88
75451	.61
75452	.61
75453	.61
75454	.61
75491	.81
75492	.81
75493	1.09
75494	1.19
MC1488N	.90
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LM320MP-5	1.30
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LM320MP-[illegible]	1.30
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LM325N	2.70
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LM349N	1.60
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MC1496N	.70
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NE540L	2.04
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NE559N	2.40
NE560B	2.50
NE561B	2.50
NE562B	2.50
NE565A	1.25
NE566V	1.28
NE567V	1.36
UA709CV	.44
UA710CV	.44
UA711CA	.53
UA723CA	.60
UA733CA	.75
UA741CV	.44
UA747CA	.70
UA748CV	.49
UA7805CU	1.25
UA7806CU	1.25
UA7808CU	1.25
UA7810CU	1.25
UA7812CU	1.25
UA7812CU	1.25
UA7815CU	1.25
UA7818CU	1.25
UA7824CU	1.25
UA78L05ACZ	.40
UA78L06ACZ	.40
UA78L08ACZ	.40
UA78L10ACZ	.40
UA78L12ACZ	.40
UA78L15ACZ	.40
UA78L18ACZ	.40
UA78L24ACZ	.40
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1N5227B	3.6V	1N5243B	13V
1N5228B	3.9V	1N5244B	14V
1N5229B	4.3V	1N5245B	15V
1N5230B	4.7V	1N5246B	16V
1N5231B	5.1V	1N5247B	17V
1N5232B	5.6V	1N5248B	18V
1N5233B	6.0V	1N5249B	19V
1N5234B	6.2V	1N5250B	20V
1N5235B	6.8V	1N5251B	22V
1N5236B	7.5V	1N5252B	24V
1N5237B	8.2V	1N5253B	25V
1N5238B	8.7V	1N5254B	27V
1N5239B	9.1V	1N5255B	28V
1N5240B	10V	1N5256B	30V
1N5241B	11V	1N5257B	33V

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5001K Digi-Clock Kit (includes MA1003 and 401)	21.90

SILICON TRANSISTORS

	UNIT	10	100	1000
MPS918	.21	1.80	16.00	140.00
MPS930	.21	1.80	16.00	140.00
MPS2222A	.16	1.55	14.00	125.00
MPS2369A	.24	2.00	18.00	160.00
MPS2907A	.16	1.55	14.90	145.00
MPS3392	.21	1.80	16.00	140.00
MPS3393	.21	1.80	16.00	140.00
MPS3394	.21	1.80	16.00	140.00
MPS3395	.21	1.80	16.00	140.00
MPS3563	.21	1.80	16.00	140.00
MPS3565	.21	1.80	16.00	140.00
MPS3638A	.21	1.80	16.00	140.00
MPS3641A	.21	1.80	16.00	140.00
MPS3643	.21	1.80	16.00	140.00
2N3055	1.47	12.25	110.25	980.00
2N3904	.21	1.80	16.00	140.00
2N3906	.21	1.80	16.00	140.00
2N4124	.21	1.80	16.00	140.00
2N4126	.22	1.83	16.45	146.00
2N4401	.21	1.80	16.00	140.00
2N4403	.21	1.80	16.00	140.00
2N4410	.24	2.00	18.00	160.00
2N5087	.24	2.00	18.00	160.00
2N5089	.24	2.00	18.00	160.00
2N5210	.27	2.25	20.25	180.00
MPF102	.54	4.50	40.50	360.00
2N5457	.51	4.25	38.25	340.00
MPSA13	.27	2.25	20.25	180.00
MJ2955	1.47	12.25	110.25	980.00
TIP120	1.17	9.75	87.75	780.00

5% CARBON FILM RESISTORS

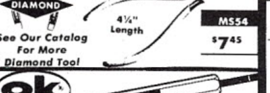
1/4 WATT RESISTOR ASSORTMENTS

Catalog number	Description	PRICE
RS125	Set of 5 each of the 73 standard 5% 1/4 watt carbon film resistors in the series 1.0, 1.2, 1.5, 1.8, 2.2, etc.... through 1.0 megohm (365 total pcs.)	$9.90
RS225	Set of 5 each of the 72 standard 5% 1/4 watt carbon film resistors in the series 1.1, 1.3, 1.6, 2.0, 2.4, etc.... through 910 kilohm (360 total pcs.)	$9.90

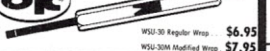
1/2 WATT RESISTORS ASSORTMENTS

Catalog Number	Description	PRICE
RS150	Set of 5 each of the 73 standard 5% 1/2 watt carbon film resistors in the series 1.0, 1.2, 1.5, 1.8, 2.2, etc.... through 1.0 megohm (365 total pcs.)	$9.90
RS250	Set of 5 each of the 72 standard 5% 1/2 watt carbon film resistors in the series 1.1, 1.3, 1.6, 2.0, 2.4, etc.... through 910 kilohm (360 total pcs.)	$9.90

DIGI-KEY MEANS QUALITY PRODUCTS



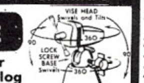
See Our Catalog For More Diamond Tool



WSU-30 Regular Wrap	$6.95
WSU-30M Modified Wrap	$7.95

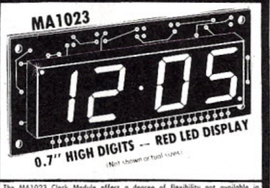
STRIPS — WRAPS — UNWRAPS

PANAVISE



Call or Write for the Digi-Key Catalog for Panavise Details

NEW! THE MA1023 by NATIONAL SEMICONDUCTOR THE "PROGRAMMABLE" CLOCK MODULE



The MA1023 Clock Module offers a degree of flexibility not available in conventional clock modules. This has been accomplished by manufacturing into each MA1023 Module a set of options over which you, the user, has total control. In a very real sense, this control allows you to program the MA1023 to fit your specific application.

It is the MA1023 user that determines whether his module will operate in a 12 or 24 hour mode. It is the user that selects his preference of a fixed or flashing colon. And, by the simple introduction of a potentiometer the user gains continuous control over the module display brightness.

But probably the ultimate feature offered by the MA1023 Module is the unique back-up oscillator option that allows for continuous time keeping during power failures with a single 9 volt battery and an external 5M potentiometer. This means that when other clocks grind to a halt, the MA1023 runs on.

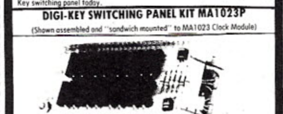
And if an alarm is your delight, the MA1023 makes it easy. Simply connect the buzzer to the alarm circuit and you're ready to go. Finally, an alarm circuit that calls for no complex intervening circuitry. The large 0.7" red led display, low power consumption, leading zero-blanking and many other excellent features are offered at this remarkably low cost.

After reading through the features, we are confident that you will agree that there is no question that the MA1023 "Programmable" clock module is truly unique.

And to enhance the MA1023 kit even more, Digi-Key is introducing a specially designed switching panel kit complete with standoffs and hardware for "sandwich mounting" with the MA1023 module. But if your preference or needs dictate remote mounting of the switching panel — no problem. You will still enjoy the straight forward one-to-one pin connection offered by the Digi-Key switching panel kit and MA1023 module. Furthermore, the printed circuit board that provides the basis for the switching panel incorporates circuitry that will speed and simplify completion of the project. In addition to the simplicity offered by the Digi-Key switching panel, the low profile, light touch, panasonic switches utilized will add quality and professionalism to your finished product. Order your MA1023 "Programmable" clock module and specially designed Digi-Key switching panel today.

DIGI-KEY SWITCHING PANEL KIT MA1023P

(Shown assembled and "sandwich mounted" to MA1023 Clock Module)



Catalog No.	Description	COST
MA1023M	MA1023 Clock Module Only (Assembled and tested)	$9.95
MA1023P	Digi-Key Switching Panel Kit for MA1023 (Includes P.C. Board, Switches, Wraposts Standoffs, Hardware, Components)	6.95
MA1023T	Special Transformer For MA1023	2.95
MA1023B	Alarm Buzzer for MA1023	2.25
MA1023K	Includes MA1023M, P, T, & B	19.95
MA1023C	Conventional switch set for applications where MA1023P is not used ... includes one 501PB and six 502PB	2.50

New Low Price WIRE-WRAPPING WIRE PRE CUT — PRE STRIPPED

Wire for Wire Wrapping, AWG-30 (0.25 MM) KYNAR Wire, 100 Wires per package Stripped 1" Both Ends

B3	30-AWG Blue Wire, 3" Overall Length	$.99
R3	30-AWG Red Wire, 3" Overall Length	.99
W3	30-AWG White Wire, 3" Overall Length	.99
Y3	30-AWG Yellow Wire, 3" Overall Length	.99
B4	30-AWG Blue Wire, 4" Overall Length	1.07
R4	30-AWG Red Wire, 4" Overall Length	1.07
W4	30-AWG White Wire, 4" Overall Length	1.07
Y4	30-AWG Yellow Wire, 4" Overall Length	1.07
B5	30-AWG Blue Wire, 5" Overall Length	1.16
R5	30-AWG Red Wire, 5" Overall Length	1.16
W5	30-AWG White Wire, 5" Overall Length	1.16
Y5	30-AWG Yellow Wire, 5" Overall Length	1.16
B6	30-AWG Blue Wire, 6" Overall Length	1.23
R6	30-AWG Red Wire, 6" Overall Length	1.23
W6	30-AWG White Wire, 6" Overall Length	1.23
Y6	30-AWG Yellow Wire, 6" Overall Length	1.23
B7	30-AWG Blue Wire, 7" Overall Length	1.30
R7	30-AWG Red Wire, 7" Overall Length	1.30
W7	30-AWG White Wire, 7" Overall Length	1.30
Y7	30-AWG Yellow Wire, 7" Overall Length	1.30
B8	30-AWG Blue Wire, 8" Overall Length	1.38
R8	30-AWG Red Wire, 8" Overall Length	1.38
W8	30-AWG White Wire, 8" Overall Length	1.38
Y8	30-AWG Yellow Wire, 8" Overall Length	1.38

JMJ DIGITAL DISPLAY BEZEL

FOR MA1002 - MA1010 AND MA1023 CLOCK MODULES

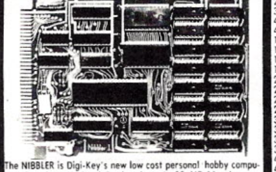
$4.95

PATENTED CHROMAFILTER SCREEN, DIE CAST METAL FRAME MOUNTS IN PANELS UP TO 3/16" THICK, NO EXPOSED HARDWARE, SCRATCH RESISTANT AND EASILY CLEANED, ELIMINATES GLARE.

MOUNTING ADAPTERS AVAILABLE TO SIMPLIFY MOUNTING AND ASSURE PERFECT ALIGNMENT.

400 BEZEL WITH RED FILTER	4.95
420 MOUNTING ADAPTER FOR MA1001 & MA1002	.69
421 MOUNTING ADAPTER FOR MA1010	.69
422 UNIVERSAL PC BOARD MOUNTING ADAPTER	.69
423 MOUNTING ADAPTER FOR MA1023	.69
401 BEZEL AND ENCLOSURE FOR MA1003	5.95

The "NIBBLER" A MICROCOMPUTER AT A MICROPRICE!



The NIBBLER is Digi-Key's new low cost personal hobby computer. Based on National Semiconductor's SC MP-11 microprocessor, the NIBBLER includes 4K NIBL Basic in ROM and 2K of RAM. The NIBBLER requires 5 volts at 1 1/2 amp providing 110 baud serial ASCII I/O which is easily interfaced with a CRT or Teletype. And our low price of $149.95 is for an assembled and tested system! Software/Hardware manual included with NIBBLER available separately for $5.00.

FEATURES:

• Assembled and Tested, yet only $149.95
• Standard 4.5" by 6.5" card with 72 pin edge connector pattern
• All IC's are socketed for easy maintenance
• Memory expandable to 28K
• 110 Baud Serial I/O
• It Speaks Basic Beautifully
• 4K NIBL Basic in ROM and 2K of RAM
• Easily Interfaced with CRT or Teletype

AND NOW AVAILABLE . . . THE "NIBBLER" POWER SUPPLY-INPUT/OUTPUT BOARD. THIS OPTIONAL BOARD GIVES YOU —

THE "NIBBLER" MICROCOMPUTER	NIBI-ND	149.95
SOFTWARE/HARDWARE MANUAL	MANI-ND	5.00
THE "NIBBLER" POWER SUPPLY	PSII-ND	39.95
22/44 PIN EDGE CONNECTOR	3776PS-ND	2.50

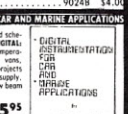
DATA BOOKS

TTL DATA BOOK, 592 P, NAT. SEMI.	9010B	$4.00
LINEAR DATA BOOK, 1978, 981 P.	9027B	$5.00
CMOS DATA BK, 77 EDIT, 555 P. NAT. SEMI.	9012B	$3.00
POWER TRANSISTORS, 151 P, NAT. SEMI.	9014B	$3.00
MEMORY DATA BK, 592 P, NAT. SEMI.	9014B	$3.00
MOS/LSI DATA BK, 713 P, NAT. SEMI.	9015B	$4.00
INTERFACE DATA BK, 464 P, NAT.	9016B	$4.00
AUDIO HANDBOOK, 196 P, NAT. SEMI.	9021B	$2.00
SC/MP MICRO. APP. HANDBK, NAT. SEMI.	9022B	$5.00
DISCRETE DATA BOOK	9024B	$4.00

DIGITAL INSTRUMENTATION FOR CAR AND MARINE APPLICATIONS

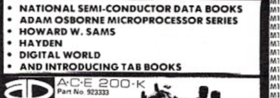
Contains easy-to-follow explanations and schematics on how to build and interface DIGITAL: clocks, tachometer, volt meter, and temperature, oil, and gas systems for cars, vans, trucks, and boats. Other interesting projects include: volt-current regulated power supply, emergency strobe lighting, and a high-low beam control system.

Published by Digital World 9080B-ND $5.95



DIGI-KEY CORPORATION, BOOKSELLER!!!

• NATIONAL SEMI-CONDUCTOR DATA BOOKS
• ADAM OSBORNE MICROPROCESSOR SERIES
• HOWARD W. SAMS
• HAYDEN
• DIGITAL WORLD
• AND INTRODUCING TAB BOOKS

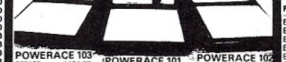


• Two 5-way binding posts • Size 4-9/16" by 5-1/8" • Kit form lowest cost

Digi-Key Stocks the Entire AP Line

728 SOLDERLESS PLUG IN TIE POINTS CAPACITY UP TO 8 16 PIN DIP's

NEW! POWERACE SOLDERLESS BREADBOARDING WITH POWER FROM AP



POWERACE 103 923103 .... $79.95 | POWERACE 101 923101 .... $84.95 | POWERACE 102 923102 .... $114.95

Bishop Graphics

The Digi-Key Catalog features many more quality Bishop Graphics products.

1X Scale PC Design Template 3365-ND 12.50

NEW! MINICONSOLES PROJECT BOXES ENCLOSURES

CALL OR WRITE FOR YOUR DIGI-KEY CATALOG

Bishop COOLGLO Light Table

110 Vac. 18"x20" Portable Light Table Cat. No. 3200-ND ..... $139.50 (Not Discountable)

PANASONIC ELECTROLYTIC CAPACITORS

VALUE	RADIAL LEADS 1	10	100	AXIAL LEADS 1	10	100
.47 50V	.12	1.03	8.53	.17	1.40	11.67
1 50V	.12	1.03	8.53	.17	1.40	11.67
2.2 50V	.12	1.03	8.53	.17	1.40	11.67
3.3 50V	.12	1.03	8.53	.17	1.40	11.67
4.7 35V	.12	1.03	8.53	.17	1.40	11.67
4.7 50V	.13	1.09	9.08	.20	1.69	14.07
10 16V	.12	1.03	8.53	.17	1.40	11.67
10 25V	.12	1.03	8.53	.17	1.40	11.67
10 35V	.13	1.09	9.08	.20	1.69	14.07
10 50V	.15	1.25	10.42	.23	1.91	15.87
22 16V	.13	1.09	9.08	.20	1.69	14.07
22 25V	.13	1.09	9.08	.21	1.74	14.49
22 35V	.18	1.48	12.33	.23	1.91	15.87
22 50V	.19	1.64	13.65	.26	2.24	18.60
33 16V	.14	1.16	9.60	.20	1.69	14.07
33 25V	.13	1.14	9.48	.23	1.91	15.87
33 35V	.19	1.61	13.40	.27	2.24	18.60
33 50V	.21	1.72	14.34	.30	2.57	21.35
47 10V	.13	1.11	9.22	.20	1.69	14.07
47 16V	.15	1.25	10.42	.23	1.91	15.87
47 25V	.15	1.25	10.42	.26	2.24	18.60
47 35V	.21	1.73	14.34	.31	2.65	22.05
47 50V	.22	1.84	15.28	.34	2.90	24.12
100 10V	.15	1.25	10.42	.23	1.91	15.87
100 16V	.19	1.61	13.40	.26	2.24	18.60
100 25V	.22	1.84	15.28	.31	2.65	22.05
100 35V	.22	1.84	15.28	.41	3.48	28.95
100 50V	.33	2.81	23.40	.43	3.61	30.04
220 10V	.21	1.74	14.48	.28	2.34	19.50
220 16V	.22	1.84	15.28	.31	2.65	22.05
220 25V	.22	1.74	14.48	.42	3.57	29.75
220 35V	.36	3.09	25.70	.49	4.14	34.44
220 50V	.46	3.92	32.59	.58	4.94	41.10
330 6V	.21	1.74	14.48	.28	2.34	19.50
330 10V	.22	1.84	15.28	.31	2.65	22.05
330 16V	.32	2.75	22.85	.42	3.57	29.49
330 25V	.31	2.60	21.64	.48	4.06	33.78
330 35V	.46	3.92	32.59	.54	4.62	38.48
330 50V	.75	6.41	53.39	.73	6.19	51.57
470 6V	.21	1.78	14.77	.31	2.65	22.05
470 10V	.32	2.68	22.32	.42	3.57	29.48
470 16V	.34	2.92	24.33	.47	4.02	33.47
470 25V	.36	3.09	25.70	.55	4.72	39.28
470 35V	.57	4.89	40.73	.62	5.25	43.70
470 50V	.83	7.09	59.03	.88	7.50	62.43
1000 6V	.34	2.84	23.66	.47	4.02	33.34
1000 10V	.37	3.10	25.80	.52	4.42	36.80
1000 16V	.44	3.75	31.23	.57	4.86	40.43
1000 25V	.75	6.41	53.39	.80	6.84	56.99
1000 35V	.80	6.85	57.02	.94	7.98	66.48
2200 6V	.48	4.08	33.94	.57	4.86	40.72
2200 10V	.62	5.30	44.13	.74	6.30	52.64
2200 16V	.80	6.85	57.02	.88	7.50	62.28
2200 25V	1.04	8.94	74.48	1.11	9.45	78.68
3300 6V	.67	5.70	47.49	.78	6.61	55.08
3300 10V	.80	6.83	56.92	.94	7.98	67.03
3300 16V	1.05	8.94	74.48	1.11	9.45	78.68
3300 25V	1.48	12.64	105.39	1.54	13.12	109.30
4700 6V	.83	7.09	59.03	.99	8.47	70.54
4700 10V	.99	8.43	70.25	1.22	10.43	86.84
4700 16V	1.46	12.45	103.75	1.49	12.76	106.37
6800 6V	.99	8.43	70.25	1.21	10.36	86.27
6800 10V	1.38	11.81	98.37	1.48	12.63	105.25
6800 16V				1.89	16.19	134.88
10,000 6V	1.38	11.81	98.37	1.47	12.55	104.54
10,000 10V				1.89	16.19	134.88

PANASONIC POLYESTER CAPACITORS

100 VDC plus minus 10% TOLERANCE

PART NO.	CAP (UFD)	PRICES 1	PAK OF 10	PAK OF 100	PAK OF 1000
M1102	.001	.11	.95	8.58	68.60
M1122	.0012	.11	.95	8.58	68.60
M1152	.0015	.11	.95	8.58	68.60
M1182	.0018	.11	.95	8.58	68.60
M1222	.0022	.11	.95	8.58	68.60
M1272	.0027	.11	.95	8.58	68.60
M1332	.0033	.11	.95	8.58	68.60
M1392	.0039	.11	.95	8.58	68.60
M1472	.0047	.11	.95	8.58	68.60
M1562	.0056	.11	.95	8.58	68.60
M1682	.0068	.11	.95	8.58	68.60
M1822	.0082	.11	.95	8.58	68.60
M1103	.01	.11	.95	8.58	68.60
M1123	.012	.11	.95	8.58	68.60
M1153	.015	.11	.95	8.58	68.60
M1183	.018	.11	.95	8.58	68.60
M1223	.022	.11	.95	8.58	68.60
M1273	.027	.12	1.03	9.37	75.00
M1333	.033	.13	1.13	10.25	85.80
M1393	.039	.13	1.13	10.25	85.80
M1473	.047	.13	1.13	10.25	85.80
M1563	.056	.13	1.13	10.25	85.80
M1683	.068	.13	1.23	12.08	96.80
M1823	.082	.16	1.42	12.88	103.00
M1104	.1	.17	1.48	13.40	107.20
M1124	.12	.18	1.60	14.55	116.40
M1154	.15	.20	1.78	16.15	128.80
M1184	.18	.22	2.01	18.25	146.00
M1224	.22	.27	2.16	19.58	156.60
M1274	.27	.30	2.33	21.18	169.40
M1334	.33	.30	2.54	23.05	184.40
M1394	.39	.30	2.69	24.45	195.20
M1474	.47	.34	2.84	25.75	206.00

PANASONIC METALLIZED POLYESTER CAPACITORS

250 VDC plus minus 10% TOLERANCE

PART NO.	CAP (UFD)	PRICES 1	PAK OF 10	PAK OF 100	PAK OF 1000
E2103	.01	.16	1.47	13.34	106.70
E2123	.012	.16	1.47	13.34	106.70
E2153	.015	.16	1.47	13.34	106.70
E2183	.018	.16	1.47	13.34	106.70
E2223	.022	.16	1.47	13.34	106.70
E2273	.027	.16	1.47	13.34	106.70
E2333	.033	.16	1.47	13.34	106.70
E2393	.039	.16	1.47	13.34	106.70
E2473	.047	.16	1.47	13.34	106.70
E2563	.056	.18	1.65	15.06	120.40
E2683	.068	.18	1.65	15.06	120.40
E2823	.082	.18	1.65	15.06	120.40
E2104	.10	.19	1.73	15.74	125.90
E2124	.12	.21	1.92	17.20	137.60
E2154	.15	.22	2.04	18.49	147.90
E2184	.18	.24	2.19	19.93	159.40
E2224	.22	.26	2.39	21.73	173.80
E2274	.27	.29	2.61	23.67	189.30
E2334	.33	.31	2.84	25.82	206.50
E2394	.39	.34	3.08	27.95	223.60
E2474	.47	.37	3.39	30.82	246.50
E2564	.56	.40	3.59	32.64	261.10
E2684	.68	.44	3.97	36.03	288.20
E2824	.82	.49	4.45	40.13	321.00
E2105	1.0	.53	4.78	43.43	347.40
E2155	1.5	.71	6.55	59.48	475.80
E2185	1.8	.81	7.39	70.24	561.90
E2225	2.2	.87	7.91	71.89	575.10

PANASONIC RESIN DIPPED TANTALUM CAPACITORS

Part No.	Cap (uF)	Voltage (V. DC)	Prices 1	Pak of 10	Pak of 100	Pak of 1000
F35ER1	0.1	35	.23	1.80	16.30	130.30
F35ER15	0.15	35	.23	1.80	16.30	130.30
F35ER22	0.22	35	.23	1.80	16.30	130.30
F35ER33	0.33	35	.23	1.80	16.30	130.30
F35ER47	0.47	35	.23	1.80	16.30	130.30
F35E68	0.68	35	.23	1.80	16.30	130.30
F25E1	1.0	25	.23	1.80	16.30	130.30
F16E1R5	1.5	16	.23	1.80	16.30	130.30
F16E2R2	2.2	16	.26	2.10	18.20	145.70
F16E3R3	3.3	16	.28	2.30	20.30	162.20
F16E4R7	4.7	16	.33	2.60	23.10	184.60
F16E6R8	6.8	16	.38	3.00	26.80	214.30
F16E10	10	16	.46	3.60	32.80	262.20
F16E15	15	16	.54	4.30	38.60	308.80
F16E22	22	16	.60	4.70	42.90	343.10

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KA4A53	KOA53	5.0K	.32	2.40	21.00	160.00
KA4A14	KOA14	10K	.32	2.40	21.00	160.00
KA4A24	KOA24	20K	.32	2.40	21.00	160.00
KA4A54	KOA54	50K	.32	2.40	21.00	160.00
KA4A15	KOA15	100K	.32	2.40	21.00	160.00
KA4A25	KOA25	200K	.32	2.40	21.00	160.00
KA4A55	KOA55	500K	.32	2.40	21.00	160.00

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.0022/1000V	.16	1.32/10	10.35/C	.047/250V	.15	1.25/10	10.00/C
.0033/1000V	.16	1.32/10	10.35/C	.068/250V	.17	1.44/10	11.50/C
.0047/630V	.14	1.15/10	9.00/C	.1/100V	.19	1.55/10	12.65/C
.0068/630V	.14	1.15/10	9.00/C	.22/100V	.25	2.19/10	17.25/C
.01/630V	.16	1.32/10	10.35/C	.33/100V	.35	2.88/10	22.45/C
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.0022 UF	.40/10	3.50/C
.0047 UF	.40/10	3.50/C
.01 UF	.45/10	3.65/C
.022 UF	.50/10	4.00/C
.047 UF	.70/10	5.60/C
.1 UF	1.35/10	11.50/C

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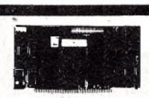

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INTRODUCTION

Use of the computer as a serious hobby has been in existence for several years. One continuing problem for the hobbyist is communications. The computerists need to establish a means of communicating among themselves in order to expand and develop their software libraries. In addition, as more and more data base systems come on line, the serious hobbyist will desire to have access to these information sources.

The 300 baud modem offers a solution to both problems. This modem, when properly configured, will allow hobbyists to communicate and exchange programs using normal telephone circuits. Also, the use of the 300 baud frequency shift keying technique is advantageous because most large computer installations presently have communication channels allocated to 300 baud. These are a standard pair of frequencies for all installations which conform to the USA low speed (0-300 bps) communication networks.

Motorola Semiconductor Division has developed the MC14412 universal low-speed modem chip which will satisfy this requirement. The MC14412 is a complete FSK modulator and demodulator. Once a filter, power supply, RS-232 interface and acoustic coupling hardware have

RS-232 refers to the standard EIA RS-232C data communications interface. The Electronic Industries Association (EIA) has released the RS232C specification detailing the requirements for the interface between data processing equipment and data communications equipment. This standard specifies not only the number and type of interface leads, but also the voltage levels to be used. The MC1488 quad driver and its companion circuit, the MC1489 quad receiver, provide a complete interface system between DTL or TTL logic levels and the RS232C defined levels.

The MC14412 low-speed modem can be used in many different designs. These include full duplex, half duplex, simplex, originate only, answer only, answer/originate and others.

The pinout configuration, Figure 2, allows the MC14412 to be programmed for a variety of configurations.

Brief development of the available options of the MC14412 will allow each individual computerist to design the acoustic modem to his or her needs and applications. In addition, it will quickly familiarize the individual with the modem and its characteristics.

The type input selects either the U.S. or CCITT operational frequencies for both transmitting and receiving

Why Not An Acoustic Coupled Modem?

By Jack Whitmore
Systems Engineer, Computer/Federal Strategic Marketing
Motorola Inc., Semiconductor Group

been added as in Figure 1, the MC14412 can supply the personal computer hobbyist with a complete acoustic coupled modem ready to be used on any home telephone.

Defining the terms FSK, RS-232 modem and parts of the vocabulary of the data communications world should be most useful to establishing common levels of understanding.

The term *Modem* is the acronymic combination of the words modulator and demodulator which is representative of the functions of the MC14412.

FSK or Frequency Shift Keying is the shifting of a frequency from one frequency to another in response to a data input. The modem shifts the frequency 200 Hz from mark to space as an example.

In the case of the MC14412 and other 300 BPs modems, the originate modem transmits on the low-frequency channel (Mark 1270 Hz and Space 1070 Hz) and receives on the high-frequency channel (Mark 2225 Hz and Space 2020 Hz). The answer modem transmits on the upper channel and receives on the lower.

The term *originate* refers to the modem or terminal that initiates the communications about to take place and not the direction of data. The answer modem is the responding or called station or terminal. For clarity and because the normal communication will consist of calling a data base, only the originate filter design will be illustrated.

data. When this input equals a one, the U.S. standard frequencies are selected.

The Echo input will allow the modulator to transmit a 2100 Hz tone for disabling the line echo suppressors.[1] During normal data transmission, this input should be low.

The Mode input selects the pair of transmitting and receive frequencies used during modulation and demodulation. When Mode = "1", the U.S. originate mode is selected. When Mode = "0", the U.S. answer mode is selected.

The use of the mode, type and echo options are summarized in Table 1. Once these have been properly established, the operator is ready to proceed to the transmit and receive options.

In order to transmit data, the transmit parameters must next be established. The transmit carrier will be enabled by applying a high level at this input. When this is held at ground, there will be no carrier at the transmit carrier output. The transmit carrier is a digitally-synthesized sine wave derived from a 1.0 MHz oscillator reference. Figure 4 illustrates this sine wave.

[1]In transmit and receive paths, echo supressors may be installed to prevent transmission signals from coupling into the other path when no signals are present in the opposite direction. If echo suppressors are present, the answer tone (2025 or 2225), depending on modem type, is used to disable them for full duplex operation. Half-duplex modems must delay transmission of data long enough to ensure that the echo suppressor is out of the circuit. In general this should not present a problem when using acoustic couplers.

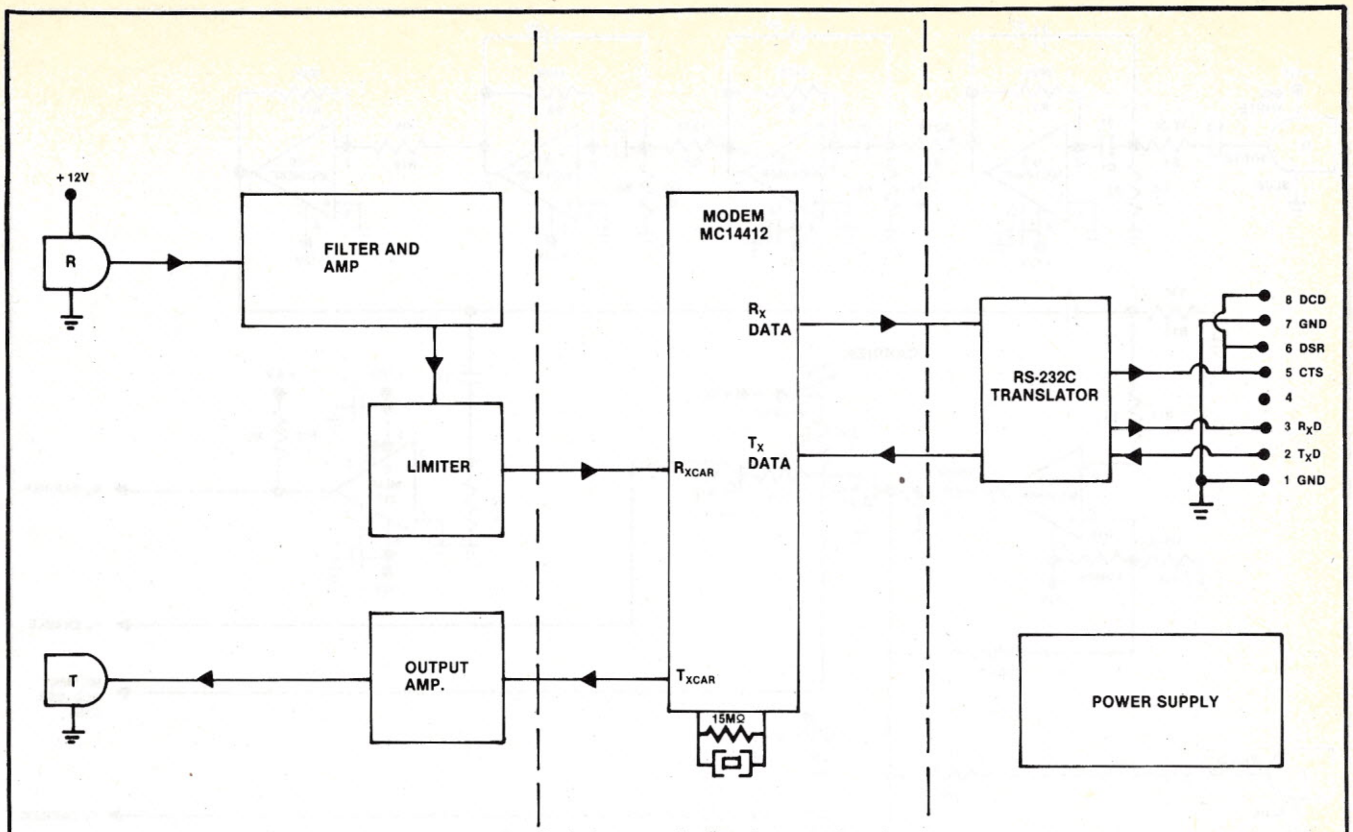

Figure 1. Originate Only Acoustic Coupler with MC14412 Modem.

Table 1.

United States Standard		**Type = "1" Echo = "0"**		
Mode		**Tx Data**		**Tx Car**
Originate	"1"	Mark	"1"	1270 Hz
Originate	"1"	Space	"0"	1070 Hz
Answer	"0"	Mark	"1"	2225 Hz
Answer	"0"	Space	"0"	2025 Hz
C.C.I.T.T. Standard		**Type = "0" Echo = "0"**		
Mode		**Tx Data**		**Tx Car**
Channel	"1"	Mark	"1"	980 Hz
No. 1	"1"	Space	"0"	1180 Hz
Channel	"0"	Mark	"1"	1650 Hz
No. 2	"0"	Space	"0"	1850 Hz
Echo Suppressor Disable Tone		**Type = "0" Echo = "1"**		
Mode		**Tx Data**		**Tx Car**
Chan. No. 2 "0"		"1"		2100 Hz

Transmit Data is the binary information input. Data entered for transmission is modulated using FSK techniques. When operating in the U.S. standard, a logic '1' input level represents a Mark.

To get the demodulator, or receiver, working properly, three options must be considered: receive data, receive carrier and receive data rate. The receive data output is the digital data resulting from demodulating the receive carrier. The receive carrier is the FSK input to the demodulator. This input must have either a CMOS or TTL compatible logic level input (see TTL pull-up disable) at a duty cycle of 50% ± 4%, that is a square wave resulting from a signal limiter. This is a very critical signal spec. to assure good demodulator performance.

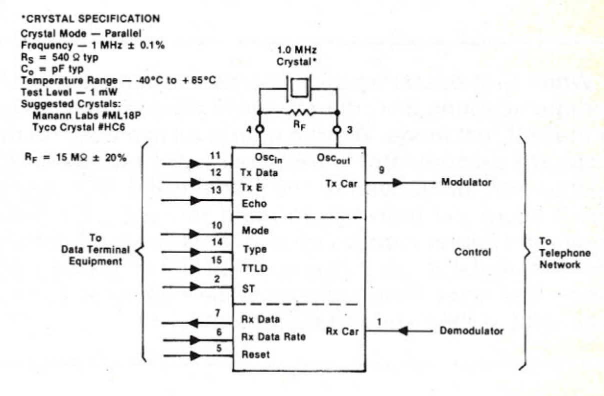

Figure 2. MC14412 Input/Output Signals

With regards to receive data rate, the demodulator has been optimized for signal to noise performance at 200, 300 and 600 bps.

Data Rate	RX Rate	Type
0-200 bps	'1'	'0' CCITT
0-300 bps	'1'	'1' AS
0-600 bps	'0'	'1' AS

Six hundred bps is not recommended unless an on premises twisted wipe pair is used. Finally, miscellaneous options must be looked at prior to designing the circuitry for the MC14412.

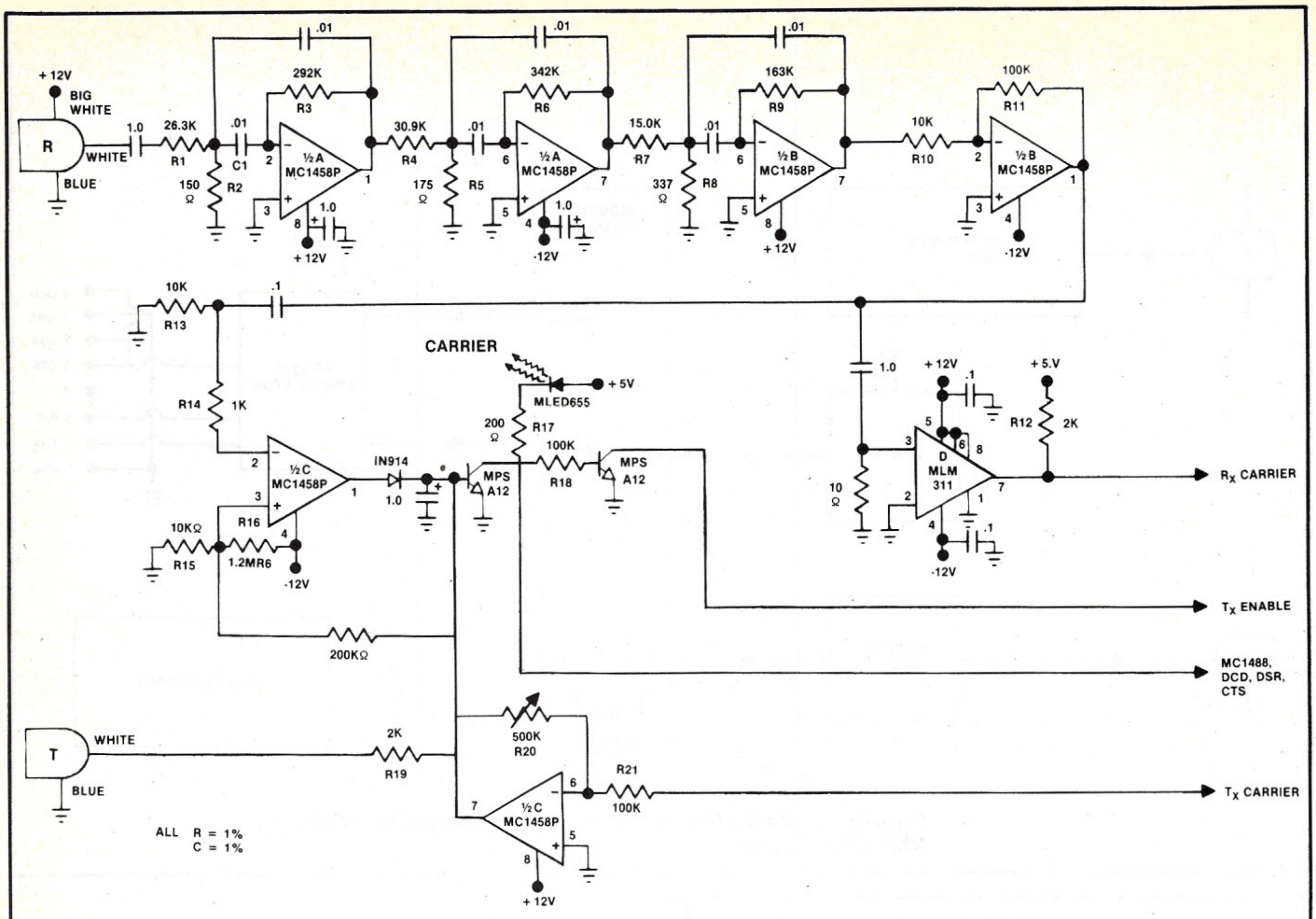

Figure 3.

When first operating or if trouble is suspected in the communications link, the MC14412 modem may be put in the self test mode. When a high level is placed on this input, the demodulator is switched to the modulator frequency and demodulates the transmitted FSK signal. The modem will then talk to itself through an external communications loop which connects the modulator to the demodulator. As a result, when using the self test mode, the filter frequency must be changed. Receive data should then equal transmit data.

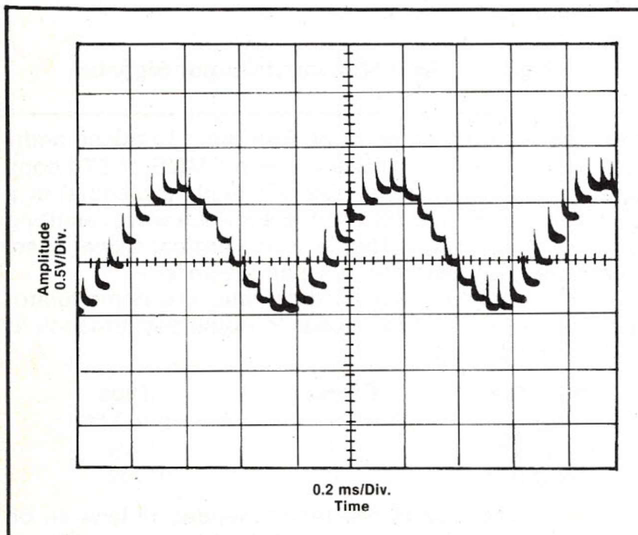

Figure 4. MOS Synthesized 1270-Hz Sine Wave.

If an application should arise where it would be advantageous to leave the modem on line with the demodulator disabled, the reset option should be exercised. This input is normally provided to decrease the test of time of the chip. In normal operation this input may be used to disable the demodulator (Reset = '1'). Otherwise, it should be tied low.

To allow the modem to establish the internal timing necessary, a 1 MHz clock must be established from either a 1 MHz source or a 1 MHz crystal. The crystal required is the same type used on the MC6800 microprocessor. When using a crystal, it is most important to locate the crystal as close as practical to the input pins. In addition, the 15 MO resistor is a definite requirement for oscillator stability. If a 1 MHz source is used, a 0-5 VDD VDC signal can be applied to the oscillator in port.

The final option to be considered is the TTL pull-up-disable. To improve TTL interface compatibility, all of the inputs to the Model have controllable P-Channel devices which act as pull up resistors whe TTLD input is low. When the input is taken high, the pull-up is disabled, thus reducing power dissipation when interfacing with CMOS.

The most challenging portion of the acoustic modem construction will be the filter system. Figure 3 is the filter network necessary for an originate only acoustic coupled modem. This includes the filter, a carrier detect indicator and the limiter. The R and R devices are the transmitter and receiver connections in the Onmitec acoustic coupler. To get on-line transmitting data, the modulator buffer portion of Figure 3 will have to be built.

Mark/Space information that is presented to the Transmit Data input of the modem is converted to an FSK sig-

nal for transmission. The modulator output is an approximated sine wave derived from a digital-to-analog converter within the MC14412. There are eight amplitude levels per cycle. Each step has been optimized such that the composite waveform has a maximum amount of signal energy at the fundamental. Figure 4 shows the 1270 Hz transmit carrier.

The modulator output impedance is typically 2K ohms. Loading this output with an impedance less than 100K ohms can provide harmonic distortion. Therefore, a buffer amplifier is required to match impedances to the telephone transmitter. This buffer amplifier may be designed to also provide filtering if additional clean-up of the transmitted signal is required.

Excessive phase jitter results if the received signal level is low enough to approach that of the interference level at the limiter input. For this reason, additional filtering of the modulator output may be required before it feeds to the telephone on those modem designs desiring wide dynamic ranges of input signal levels.

Interference by the second harmonic is of concern in the originate mode only. In this mode the transmit signal is in the low band and its second harmonic falls in or near the passband of the return channel. In half duplex operation the transmit carrier is held at a constant Mark (1720 Hz) while data is being received. The second harmonic (2540 Hz), which is typically -30 dB or more below the fundamental in amplitude, falls just outside the passband of the receiver filter and is further attenuated. In full duplex operation the second harmonic and the modulation sidebands have about the same amount of energy. If this undesired energy must be reduced, the filter used to reduce the modulation sidebands will also reduce the second harmonic. Phase jitter and bias distortion inherent in the modulator is less than 3 μs.

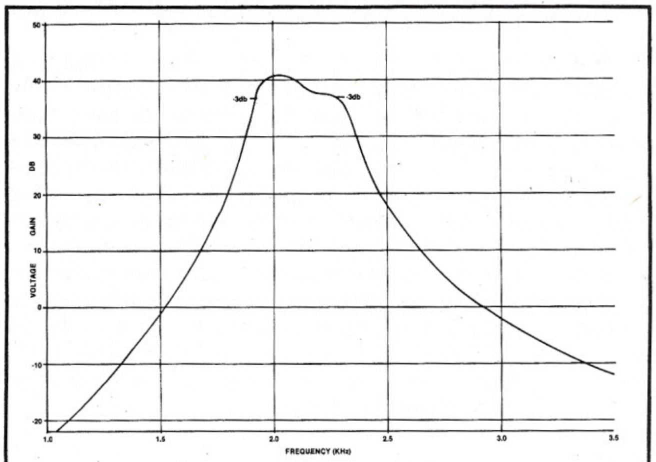

Figure 5.

To start receiving data the band pass filter illustrated in Figure 3 should develop a band pass similar to that indicated in Figure 5. To build a band pass filter for the answer mode, the component values given in Table 2 would have to be substituted for those in the schematic.

The purpose of the bandpass filter is to amplify the received signal from the remote modem while rejecting all other signals that may be present in the local modem or on the telephone line. Interference which must be filtered out has several possible sources. Each of these must be considered and dealt with individually. Noise which is coupled in through the transmission media is either impulsive or band limited (gaussian) white noise. Both of these must be analyzed on a statistical basis. Discrete interfering signals may also be coupled in through the transmission media. However, the interfering signal of

PROGRAMMERS CONTEST

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- The game must include all the prime characters in the television show.
- The game cannot be based around ships shooting ships.
- The game can utilize graphics at the start and throughout the game.
- The accompanying article must include how to play the game, and exactly how the code works.

Each submitted game will be judged on creativity, coding style, clarity of the game instructions, and how the code works.

DEADLINE AND SUBMITTAL FORMAT

All submittals must be received at the INTERFACE AGE editorial offices not later than April 1, 1979. Each submittal must be accompanied by a self-addressed stamped envelope and an IAPS formatted tape of the code. The tape must contain both source and object code. The article must be in the format described on page 32a of the March 1978 issue.

Send your entry to Carl Warren, Senior Editor, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, California 90701. Please no phone calls.

Table 2. Answer Filter

R_1	23.9KO	1%
R_2	632O	1%
R_3	212KO	1%
R_4	34.3KO	1%
R_5	900O	1%
R_6	304KO	1%
R_7	14.2KO	1%
R_8	1677O	1%
R_9	125.7KO	1%
R_{11}	1MO	1%
R_{15}	7.5KO	1%

prime importance comes from the local modulator and will always exist in the half or full duplex modes.

Since the transmission media is lossy, the local transmit carrier level will exceed the level of the received signal. For this reason, the bandpass filter must have enough selectivity to reject the local carrier to an acceptable level. Modems that are designed for a wide dynamic range of input signal levels (-15 dBm to -55 dBm) require better than 70 dB rejection of interfering signals. Most of this rejection must come from the selectivity in the bandpass filter.

Reducing the effects of band limited white noise is accomplished by decreasing the bandwidth of the filter. Determining the minimum bandwidth comes by investigating the received signal characteristics. The transmitted data can be recovered from binary FSK by properly detecting the carrier and the first sidebands. With a data rate of 300 bits per second and a data format of alternate Marks and Spaces, the first Bessell function occurs at ± 150 Hz from the carrier. All other data formats have sidebands within the ± 150 Hz limit. A minimum bandwidth of 300 Hz is then required in the bandpass filter.

The bandpass filter output is fed into an amplitude limiter. Therefore, the amount of passband ripple is not a critical parameter. An item of serious concern, however, is the phase linearity over the passband. All frequency components that pass through the filter must be equally delayed in time or jumbling and smearing of the data occurs. This is known as intersymbol or interbit interference. Performance of the communication system is degraded under these conditions with bias distortion and excessive phase jitter at the demodulator output resulting. Intersymbol interference can be reduced by linearizing the phase versus frequency transfer function. The slope of this transfer function is termed envelope delay and is determined by:

$$T_d = \frac{\Delta\phi}{\Delta f} \frac{1}{360 \text{ deg/cycle}}$$

where $\Delta\phi$ = change of phase in degrees
Δf = change of frequency in Hz

Minimizing the distortion of the envelope delay curve then minimizes the intersymbol interference. This is relatively easy over the center ⅔ of the passband. However, keeping constant delay near the band edges is quite difficult, if not impossible. For this reason, the optimum bandwidth is not determined according to the data rate but rather according to achievable linear phase characteristics. Bias distortion of one tenth of the bit period at 300 bps typically requires a -3 dB bandwidth of 450 Hz to 500 Hz.

LIMITER-THRESHOLD DETECTOR

The demodulator in the MC14412 requires symmetrical limiting of the received signal in order to pro-

duce equal half-cycle periods. Each half-cycle period is measured in reference to an accurate time base to determine if the received frequency is a Mark or a Space. Non-symmetrical limiting produces errors in the demodulation process, thus degrading the system performance. Accurate limiting must be achievable over the expected input dynamic range. Such items as maximum input level and input offset voltage of the limiting devices must be carefully considered.

The threshold detector is used to determine if the input signal to the limiter is above the maximum detectable signal level of the modem. This is an amplitude measurement only, thus the period of the output is not critical. A comparator is used with one side biased to the peak amplitude of the desired minimum detectable signal level and the bandpass filter output. When the signal level exceeds the bias point, the comparator output goes low indicating an acceptable signal level.

The use of the MC1458P and MLM311 devices will enable the builder to develop a good quality filter from readily available components. The MC1458 is the equivalent of dual 1741's. It has wide common mode and differential ranges. It has very stable circuit characteristics. This op amp may even be considered somewhat forgiving of layout errors such as poor positioning or poor decoupling techniques. However, it cannot be stressed enough that good construction techniques will result in better performance. If linear construction techniques are unfamiliar ground, it may be worth the time and effort to learn a little about this art before proceeding with this project. In general, good RF type construction techniques also apply when one must use solid state operational amplifiers with their associated high voltage gains. The MLM311 voltage comparator is also an easily applied device that has enjoyed success with many applications including several acting as a limiter for the modem demodulator.

For those individuals who do not wish to contstruct their own filter and limiter system, there is a drop-in hybrid filter system available from Sprague Electric. When used with the MC14412, the Series 207C300 and 207C400 active filter modules will provide all of the

Table 3. RS-232C EIA Model-Terminal Interface

PIN	NAME	FUNCTION	EIA CKT
1	FG	Frame Ground	AA
2	TD	Transmitted Data	BA
3	RD	Received Data	BB
4	RTS	Request to Send	CA
5	CTS	Clear to Send	CB
6	DSR	Data Set Ready	CC
7	SG	Signal Ground	AB
8	DCD	Data Carrier Detect	CF
9		Pos. DC Test Voltage	
10		Neg. DC Test Voltage	
11		Unassigned	
12	(S) DCD	Sec. Data Carrer Det.	SCF
13	(S) CTS	Sec. Clear to Send	SCB
14	(S) TD	Sec. Trans Data	SBA
15	TC	Transmitter Clock	DB
16	(S) RD	Sec. Rec. Data	SBB
17	RC	Receiver Clock	DD
18		Receiver Dibit Clock	
19	(S) RTS	Sec. Request to Send	SCA
20	DTR	Data Terminal Ready	CD
21	SQ	Signal Quality Detect	CG
22	RI	Ring Indicator	CE
23		Data Rate Select	CH/C
24	(TC)	Ext. Transmitter Clock	D
25		Busy	

necessary filtering for originate only, answer only or answer/originate operation.

The series 207C300 transmit filter modules feature a well designed six-pole active filter to suppress output sidebands and to reduce harmonic distortion. The Type 207C300 switchable module is switched between answer and originate modes by means of a signal which can be obtained from standard low-level digital logic.

The 207C301 low-band filter is designed for originate only applications. The 207C302 high-band filter is used for answer only applications. Each of these devices has an input buffer amplifier with jumper-selected gains of 0 or 20 dB. Intermediate gains may be user-selected by means of an appropriate external resistor.

The Series 207C400 receive filters include a ten-pole active filter to eliminate noise and local carrier signals. The Type 207C401 high-band module is designed for originate only applications. The Type 207C402 low-band module is for answer only applications. These devices also include the input buffer amplifier with selectable gains between 0 and 20 dB, and in addition feature a symmetrical 50-50 duty cycle output limiter to provide

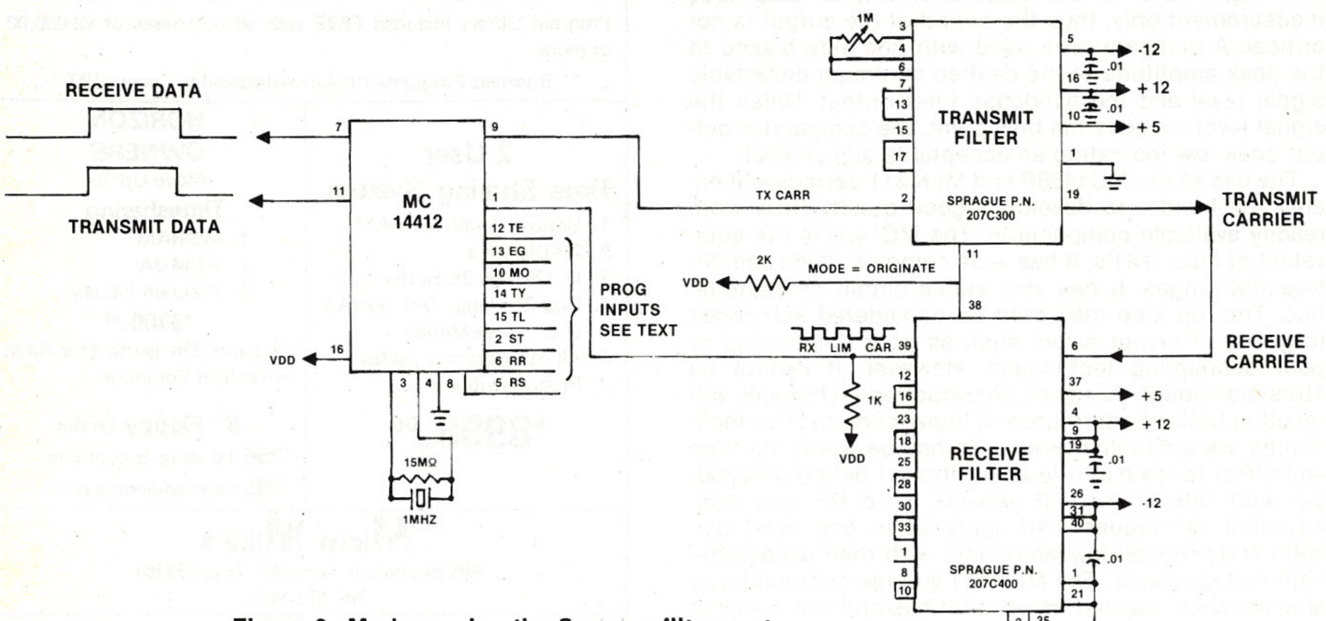


Figure 6. Modem using the Sprague filter system.

equal half-cycle periods to the demodulator. Figure 6 illustrates the simplicity of building a modem incorporating the Sprague filter system and MC14412.

The interfacing of the acoustic coupled modem to the computer is accomplished by the use of the RS-232 interface technique. Though not absolutely required, the use of the RS-232 is recommended. If the use of the RS-232 interface is accomplished, the end result will be a modem that is much more flexible in its applications.

The pinouts required by the modem interface are given in Table 3. These pinouts for the EIA RS232C standard 25 pin plug, if incorporated, would allow the modem to communicate up to 50 feet, as per RS232 specifications.

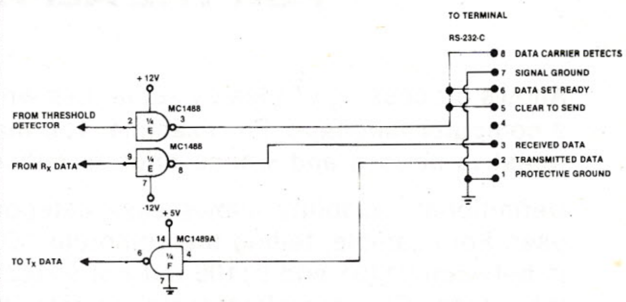


Figure 7.

Figure 7 illustrates the RS232C interconnects that are required for the acoustic modem. These would be required if the acoustic coupler is to be equipped to properly interface with any terminal equipped with RS232 specified interface plug. The MC1489 line receiver and MC1488 line driver may be incorporated in the design to provide proper level translation. These two devices will accommodate the level translation necessary to move from the ± voltage levels on the RS232 Bus to the 0-5VDC digital levels necessary at the terminal and modem ends.

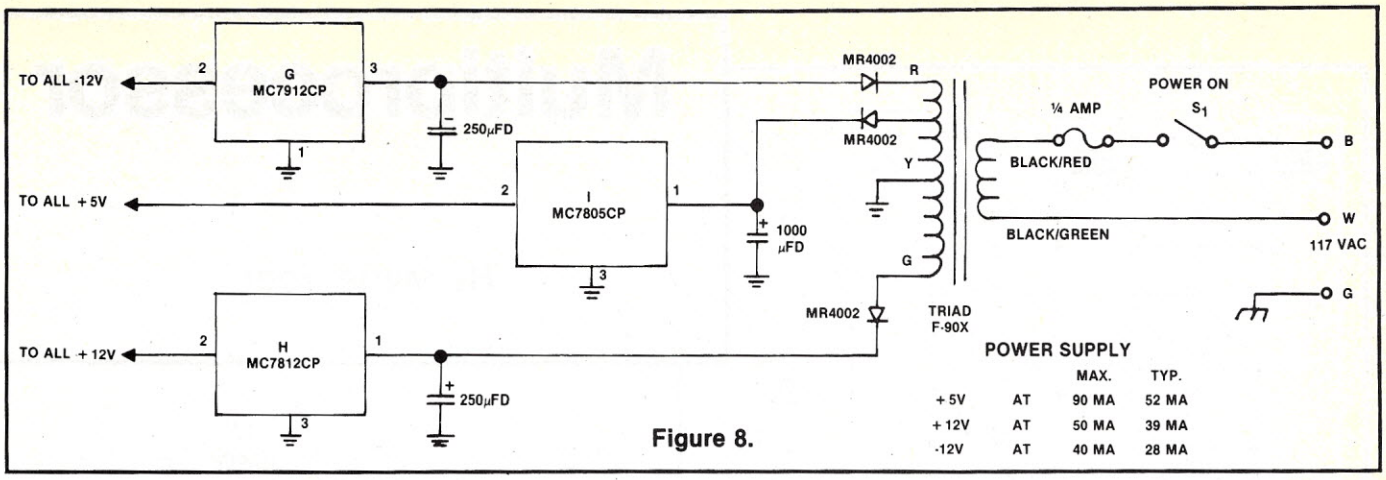
A built-in power supply is the most practical way to supply the DC requirements of the acoustic modem. The power supply would have to supply ± 12 VDC as well as + 5 VDC for logic levels. The supply illustrated in Figure 8 is a simple and inexpensive power supply that may be constructed using easily obtainable solid state regulators.

The mechanics of acoustically coupling the telephone handset to the modem can result in poor overall performance even if careful attention has been given to all aspects of the electrical design. The handset receiver should be designed for maximum immunity to external noise and shock interference. In addition, for top performance, the mechanical design should incorporate parameters that will eliminate mechanical and acoustic resonances in the operating frequency range.

Omnitec Corporation at 2405 S. 20th Street, Phoenix, AZ 85034, is a manufacturer of acoustic coupled

Table 4.

Item	Description	Qty.	Part Number
1	Cover	1	E102095 P1
2	Base	1	E102096 P1
3	Cushion	2	C102088 P1
4	Receiver Assembly	1	B102137 G1
5	Connector	1	E102090 P24
6	Switch, Push Button	1	E102090 P9
7	Power Cord	1	E102090 P23
8	Indicator Light	1	E102090 P7
9	Lighted Rocker Switch	1	E102090 P6
10	Fuse Holder	1	E102090 P18
11	Pad	4	A102098 P1



POWER SUPPLY		MAX.	TYP.
+5V	AT	90 MA	52 MA
+12V	AT	50 MA	39 MA
-12V	AT	40 MA	28 MA

Figure 8.

modems. This company will supply the hardware components for those individuals who do not wish to design and build the hardware involved with this portion of the project. Table 4 contains a list of the components and the Omnitec part numbers.

Data sheets describing the MC14412 and its electrical and operating characteristics may be found by consulting Volume 5 (CMOS) of the *Motorola Semiconductor Data Library*. The MC1458, MLM311, MC1488, MC1489, MC7800, and MC7900 device parameters may be found by consulting Volume 6 (Linear IC's) of this same library set. Further information regarding these data sheets may be obtained by contacting your local distributor or sales representative.

Once the unit has been assembled, it is ready to set up. The transmit level should be immediately and properly calibrated. This level is very critical since the modem should not be overdriving the telephone lines. To set the acoustic output, use a telephone transmitter for a receiver and set the level to 2.0mV RMS at the outputs of the transmitter. If the transmit level is greater than -17 dBm with a telephone handset in the telephone coupler, there is danger of the threshold detector being activated.

The acoustic modem is now ready to start sending and receiving data. If trouble is encountered, the most common difficulty with this type of modem is with the acoustic coupling between the handset and modem. Care must be exercised to allow as air tight a fit as possible for good audio coupling.

From here on, you should be on line with anybody or anything who is also on line at 300 bps. This method should provide an economical solution to the long sought after common communications interchange between computer hobbyists since many clubs are now looking into and developing equivalent systems. The ability to exchange data is only a phone call away. □

Multiprocessor

By Merle Vogt

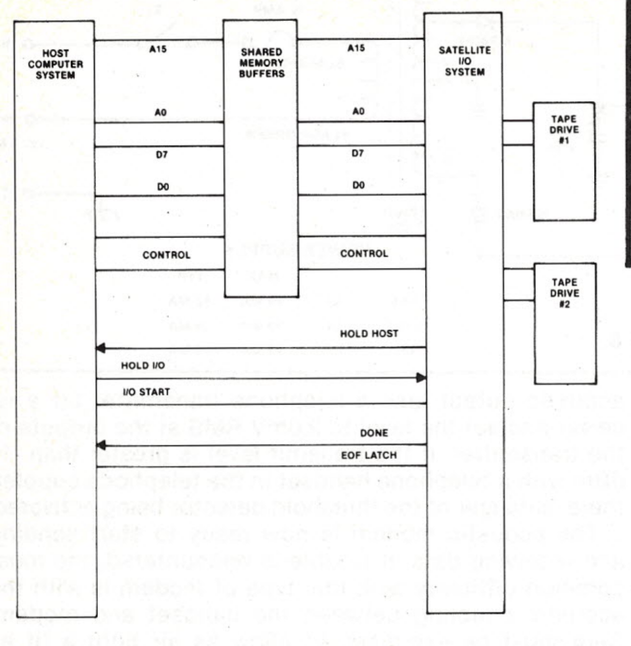


Figure 1. Multiprocessor System Logic

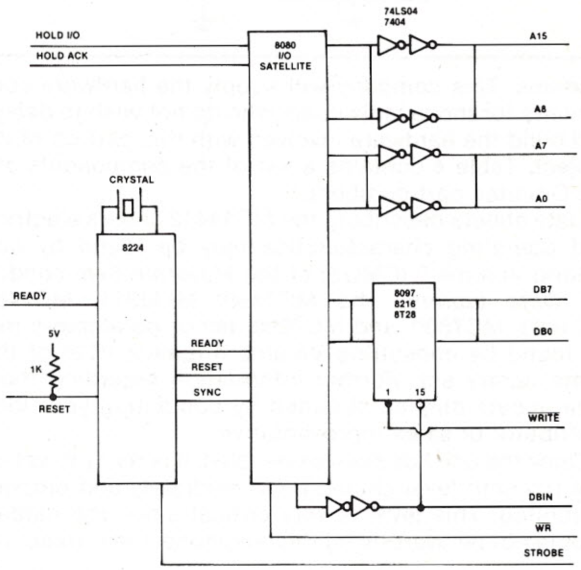


Figure 2. I/O Satellite CPU.

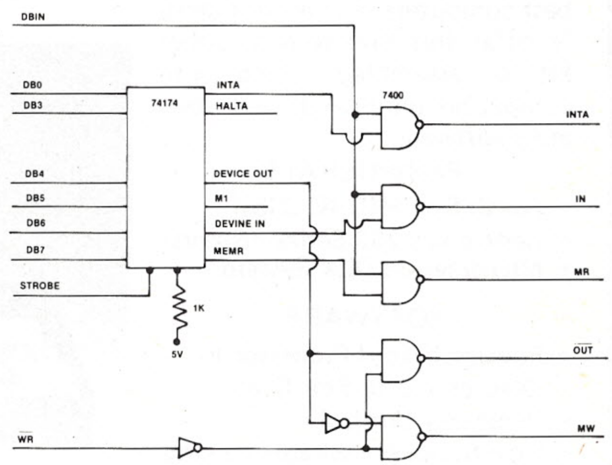


Figure 3. Satellite Status Latch.

The applications of microprocessors as reflected in the various hobby publications is reaching a state that might best be specified as absurd misapplications. A completely bewildering flood of boards and black boxes is appearing for input/output and/or interfacing the various kits to disk, tape, printers, keyboards, etc., and almost every single one of these black boxes has been designed to be driven by the central processor unit of the host device. This is ridiculous and it completely violates the entire philosophy of having microprocessors in the first place. The big boys in the computer world realized more than a decade ago that it was bad engineering to have the CPU wasting its valuable time fooling around with input/output operations. This work was delegated to satellite processors so as to let the main CPU go about its real business of processing data.

It stands clearly demonstrated that the designers in the hobby computer field have missed the whole point by failing to create intelligent peripheral boards. The material that follows attempts to turn the tide in the direction it should be going. It outlines hardware and gives techniques for improving I/O, thereby speeding up processing.

You don't need to be told how much processing power there is in an 8080 chip, use it to drive a pair of tape decks. Consider the data logic diagram of Figure 1. There is a section of shared memory where the I/O unit will load data blocks taken from Tape 1, to be used as input by the host computer.

In turn, the host will load data blocks into the memory which will put out onto Tape 2 by the I/O unit. These are overlapped operations, of course, else the whole thing would be pointless. There is intercommunication and synchronization between the units by a scheme of hold, data ready, busy, done, etc., flags.

Figure 2 diagrams an 8080 Satellite CPU. I make no claims for great originality on some of this circuitry; generally, I have tried to keep it as cheap as possible and may not have used the latest, more sophisticated (and more expensive) chips. Often this results in more chips being used. The two 8T28s in Figure 2 could be re-

Hardware

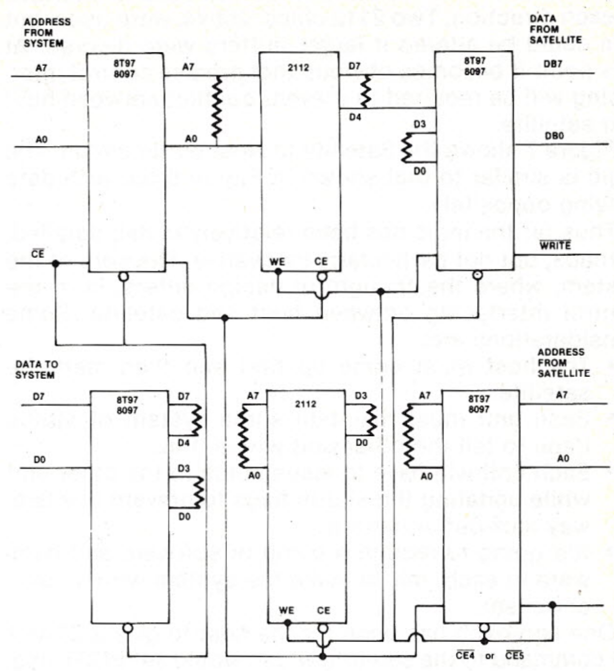


Figure 7. Input Buffer, Satellite to Host, 256 byte.

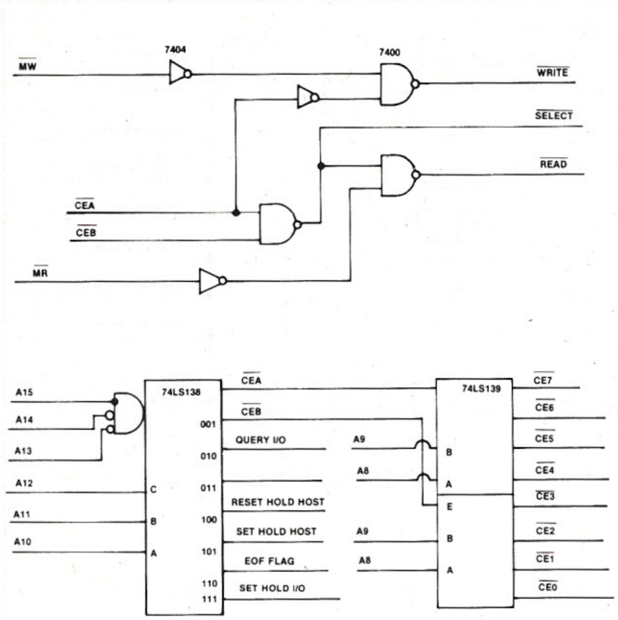


Figure 4. Satellite Memory Decoder and Control.

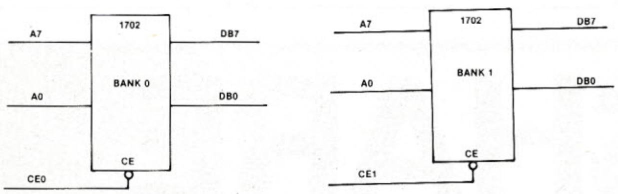


Figure 5. Satellite Program Memory.

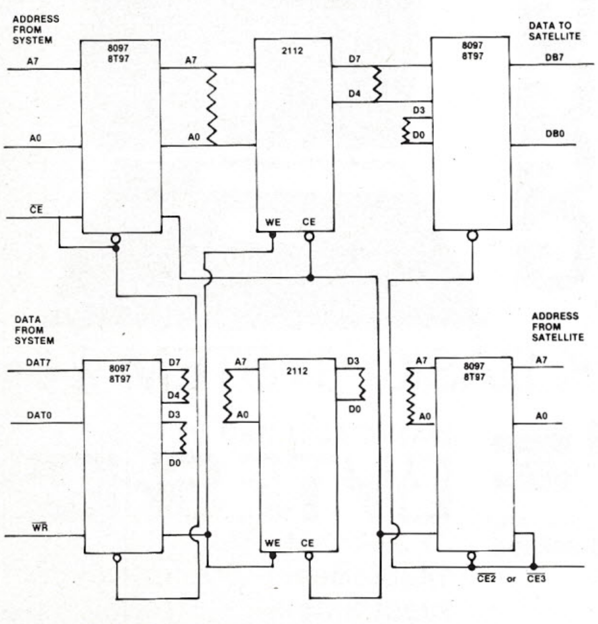


Figure 6. Output Buffer, Host to Satellite, 256 byte.

placed by four 8097s. Note that this satellite CPU is to be RESET and started by control from the host computer.

Programs for the satellite can be implemented in several ways. The simplest is to use ROM, containing a loop that alternately dumps and loads the two buffers to/from the two tape drives and waits as needed. More varied operation could be achieved by putting the satellite program into RAM, shared by the host, and have the host load the desired function and start the satellite as needed. I consider this an undesirable technique. The proper approach is to keep adding more satellites for I/O and further increase the speed of the host processor CPU.

Remember that there is not much time lost by the host CPU in these handshaking details, and with the satellites keeping all those buffers filled and emptied, the host can run at its full speed. I consider that a correctly designed system would have an I/O satellite for each two tapes, each keyboard/printer, each disk, and so on.

Figure 3 diagrams a Status Latch using a 74174. There is nothing unusual about it.

Figure 4 shows how to set up the Satellite Memory Decoder. It could be expanded to control more memory banks than shown here. Bank CEA has been selected to control the satellite program PROM banks and the host to satellite RAM buffer banks. Bank CEB is used to control the satellite to host RAM buffer banks. The address code implied by the connection of A0 through A15 can be revised as desired. In addition, the 74LS138 is used to decode signals for Holding Host CPU, Set End-of-File latch, Query I/O flags, and Set Satellite to Hold Status.

Figure 5 shows use of program memory involving 1702A EPROM. This could be revised to use other PROM as desired.

Figure 6 leads into the complexities of shared buffers. This diagram is for host to satellite buffers. These are OUTPUT buffers for the host system. There must be two of these buffers to get efficient I/O because the host will be filling one unit while the satellite is emptying the other. The host must take control of the buffer address and data lines to fill the buffer. Later the satel-

lite must take control to empty the buffer. A system of 8097 and/or 8T97 three state chips was used to interface in each direction. Two 2112 chips, 256x4, were used, but this could be altered if larger buffers were desired. At this point it becomes obvious that precise control interfacing will be required to prevent conflict between host and satellite.

Figure 7 shows the Satellite to Host buffer circuit. The logic is similar to that shown in Figure 6 but with data flowing oppositely.

Thus far the logic has been relatively trivial; detailed, perhaps, but not particularly innovative. The core of the system, where the thoughtful design enters, is in the control interfacing between host and satellite. Some considerations are:

- The host must come up first and then start the satellite.
- Each unit must maintain some system of status flags to tell the other unit where it is.
- Each unit will have to issue holds to the other unit while updating the status flags to prevent any two-way lock-out situations.
- It's going to require a blend of software and hardware in each unit to make the system work in synchronism.

One approach has been for the host to give a START I/O command to the satellite which would set BUSY flag, followed by a DONE flag which would interrupt the host and which would take appropriate action, such as starting the next I/O operation, and processing the data from the previous I/O operation. The satellite has a somewhat passive role. It queries the command flags from host to determine the function to be performed, sets the BUSY flag, does the commanded task, sets the DONE flag, and puts itself into the HOLD state. The host must wait whenever its gets around the loop before the I/O is done (this will usually be the case) and finds the BUSY flag still set on. The waiting can be reduced by putting more I/O devices on satellite channels, giving more parallel overlay I/O and speeding up the host by feeding it faster.

This increases hardware costs a definite amount and software costs moderately. However, in industry the

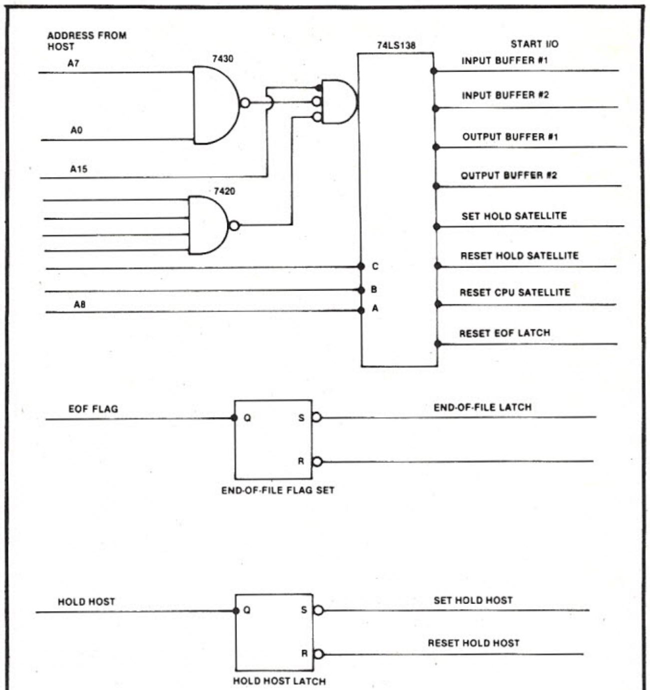


Figure 8. Satellite Control, Part 1.

system is a proven winner in the economics of faster processing and more work done per day.

Figure 8 shows part of the satellite control interfacing. The host sends command via appropriate codes on the address lines which are picked up by the 74LS138. Upon system start-up, the host must reset the End-of-File (EOF) latch and reset and start the satellite CPU. The host then can issue start I/O signals as needed to process the data in logical sequence.

Also two signals are provided for the host to put the satellite in or out of hold status as required. The EOF latch tells the host when the satellite has run out of data on the input file. A very common way to achieve this is to include a final record in the file which contains some special characters not found in normal records. The satellite examines each input record for this EOF flags and then sets the EOF latch to inform the host CPU. The HOLD HOST latch is used by the satellite to hold the host CPU while flags are being set. This avoids system synchronization problems.

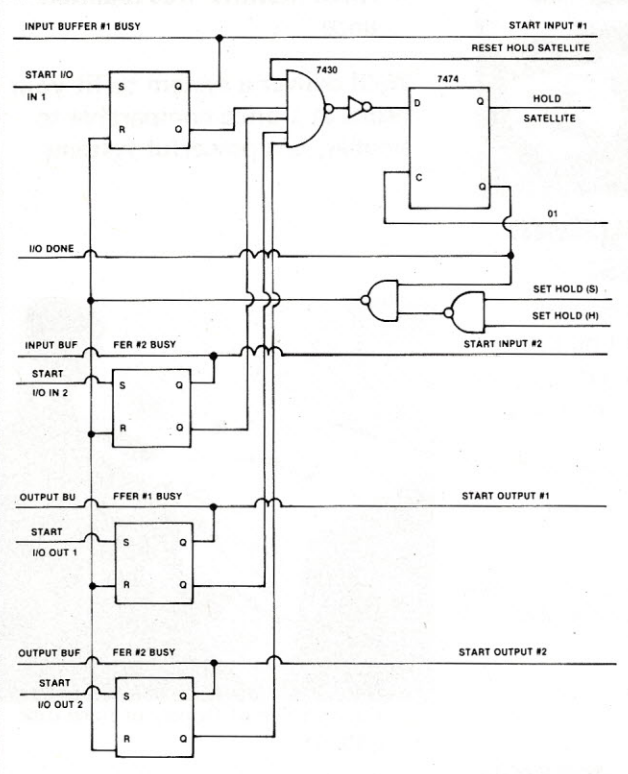


Figure 9. Satellite Control, Part 2.

Figure 9 continues the satellite control circuits. There are four I/O start latches which are set by the host. Each latch can take the satellite out of hold status via the 7430 gate. A 7474 is the satellite hold control. A zero from the 7430 is clocked in by 01 and starts the satellite by taking the hold line to low. 01 has been used to clock the shift at a definite time because the hold line must be stable by 02 time.

The satellite can then query the EXEC BUFFER lines to determine which I/O operation to process. When finished, the satellite takes down the SET HOLD line. This resets the I/O START latches, taking the D input of the 7474 to one, and the next 01 latches the satellite into hold status. Also, the HOLD SET is enabled only when the 7474 is set to run status. The four BUSY lines could be queried by the host unit as an aid in synchronizing operations. These are not necessarily required, depending on the nature of the program in the host. There is an I/O DONE flag for the host to use to determine satellite status.

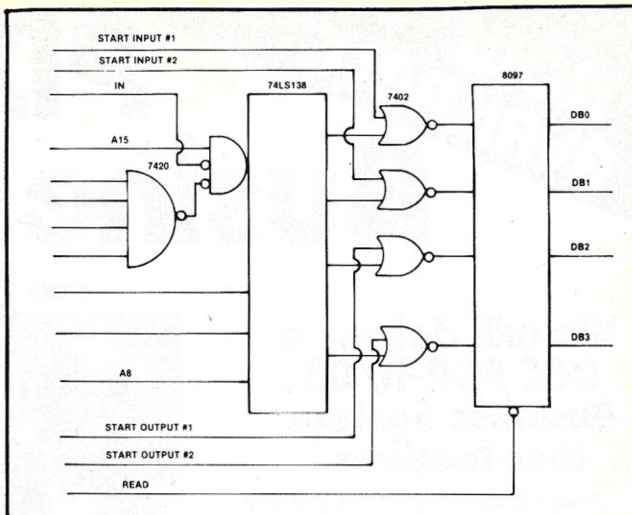


Figure 10. Query I/O Start.

Figure 10 shows a query circuit in the satellite. The four START I/O lines are clocked into the satellite CPU by an address sent to the 74LS138. These four flags will be on data lines DB0 through DB3 and can be tested to steer the satellite into the corresponding I/O subroutine for filling or emptying the selected buffer.

There must be a pair of both input and output buffers to make an effective system. The circuits of Figures 6 and 7 must be constructed in duplicate to achieve full I/O overlap operations. The logic of the system is for the satellite to be filling input buffers ahead of the processor and emptying output buffers behind the processor. □

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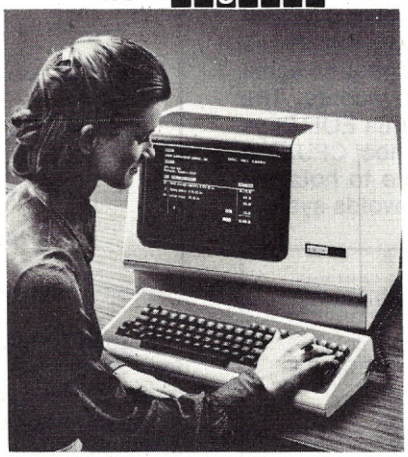

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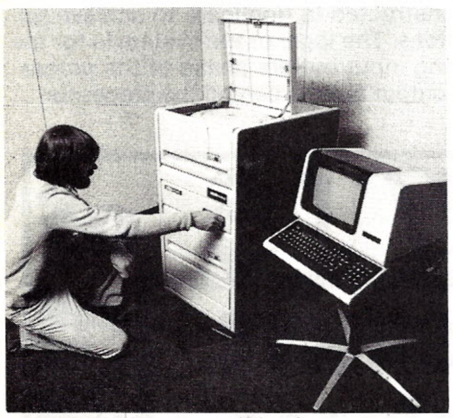

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CIRCLE INQUIRY NO. 92

NEW PRODUCTS

MICROCOMPUTERS

Digital Announces PDP-11V03-L

The second of its low-cost "L System" line of packaged computer systems, PDP-11V03-L incorporates Digital's new dual-density RX02 floppy disk peripheral and the PDP-11/03-L microcomputer.

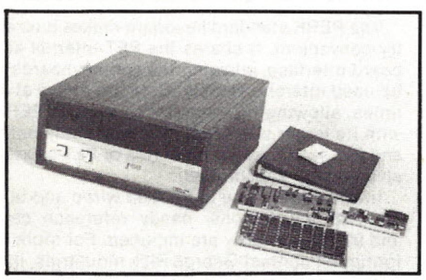
Standard software for the PDP-11V03-L is the RT-11 operating system, editor, macro assembler, and utilities. An extended floating-point instruction set can boost speed of arithmetic operations with FORTRAN IV or macro developed programs.

Priced from $10,500, the PDP-11V03-L costs about 30% below its components, if purchased separately. Quantity discounts are available. For more information contact Digital Equipment Corp., Maynard, MA 01754.

CIRCLE INQUIRY NO. 121

New Computer SS50 Compatible

The JF68 is a new, low cost microcomputer system with SS50 bus compatibility. The unit is based on the 6800 microprocessor. Sixteen slots are provided on the motherboard, which mounts in a walnut cabinet.



The power supply included with the unit has sufficient current handling capability to expand the system for additional RAM/PROM memory configurations.

The CPU board contains a powerful 2K operating system called JFBUG® that is resident in ROM memory. Existing software for any MIKBUG® type system will execute without modification. An RS-232 or current loop interface up to 9600 baud is accomplished through a serial I/O card included in the system price.

An audio cassette interface using the Kansas City Standard recording technique is located on a single I/O card.

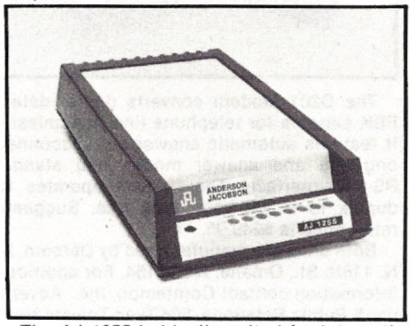
The JF68 Computer System is available in kit form for $549.95 or fully assembled and tested for $749.95. For additional information contact JF Products, 1441-5 Pomona Rd., Corona, CA 91720. All units are shipped postpaid.

CIRCLE INQUIRY NO. 122

PERIPHERALS

AJ 1255 Originate/Answer Modem

This modem features full duplex 1200 BPS operation — originate/auto answer — compatible with itself, all of Vadic's VA34XX modems and Anderson Jacobson's AJ1234 acoustic coupler.



The AJ 1255 is ideally suited for interactive TSO, message network operation, distributed data processing, etc. With the elimination of line turns, the AJ 1255 increases throughput 4-fold, reduces connect time and maintains viable data integrity.

The AJ 1255 is available without its optional telephone for $825 quantity one. For more information contact Anderson Jacobson, 521 Charcot Ave., San Jose, CA 95131, (408) 263-8520.

CIRCLE INQUIRY NO. 123

Horizon® Communications System

The Horizon Communications System is controlled by microprocessors and designed to serve business customers who require up to 80 telephones.

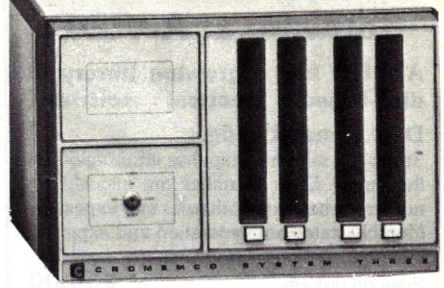
Through the use of multi-button electronic telephones, Horizon permits the user to know what is happening within the system. Tone alerting signals — different from the usual ringing of a telephone — distinguish calls from outside the system from calls placed internally.

Other features include the capability to swiftly transfer misdirected or ongoing calls to other extensions, and to reach frequently called numbers within the office by simply pressing one button.

The Horizon Communications System, which is still subject to regulatory approval, can be directed to restrict specific phones from making long distance and local calls, or from using WATS lines. A conference feature enables as many as five parties (two can be from the outside) to speak together on one call without going through an attendant.

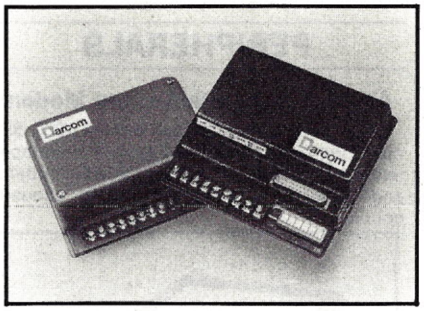
For more information contact AT&T, 195 Broadway, New York, NY 10007, (212) 393-4078, Dave Manahan.

CIRCLE INQUIRY NO. 124



Data Coupler and Modem

The D101 Data Coupler provides an automatic interface between a telephone line and customer-owned equipment, such as a modem or data terminal. It features standard Bell CBT functions, operates from a single +5 volt power supply and requires no adjustment. Suggested retail price is $149.95.



The D201 Modem converts digital data to FSK suitable for telephone line transmission. It features automatic answer and disconnect, originate and answer modes and standard RS-232 interface. The modem operates full duplex to a 300 baud data rate. Suggested retail price is $249.95.

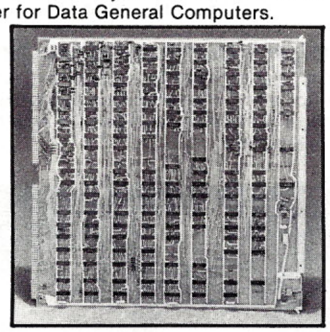
Both units are manufactured by Darcom, 268 N. 115th St., Omaha, NE 68154. For additional information contact Comtempo, Inc., Advertising & Public Relations, 504 Twin Towers North, 3001 Douglas St., Omaha, NE 68131.

CIRCLE INQUIRY NO. 125

DISKS

K-204B Disk Controller

Up to four disk cartridge units with a capacity of 2½M-bytes to 24M-bytes per drive can be accommodated by the Konan K-204B disk controller for Data General Computers.



Packaged on one 15" by 15" board the K-204B is compatible with D.G., Pertec, Diablo, Western Dynex, Microdata, and other similar disk drive units.

The controller is software transparent to almost all standard D.G. software packages including Data General's RDOS and Educational Data System's IRIS.

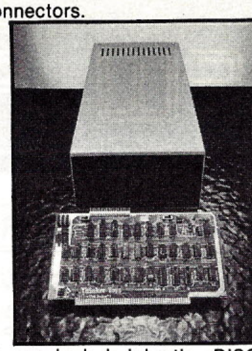
The K-204B disk controller costs $1176 in single quantities. A nine foot cable from the CPU to the firsk disk drive is $175. The K-204B is sold with an unconditional one year factory warranty. For more information contact Konan Corp., 1434 N. 27th Ave., Phoenix, AZ 85009, (602) 269-2649, Dave Baughman.

CIRCLE INQUIRY NO. 126

DISCUS I™

The new DISCUS I is a full-size floppy disk memory for S-100/8080 microprocessors systems. The DISCUS I is sold as a complete system, completely assembled and tested, with all required hardware and software.

Hardware included in the DISCUS I system includes a Shugart 800R full-size disk drive fully mounted in a custom, all-metal cabinet with an independent power supply, a Disk Jockey I™ S-100 controller with a capacity for seven additional disk drives, and all necessary cables and connectors.



Software included in the DISCUS I base price features an integrated DISK/ATE™ system containing most utilities: Disk Operating System, File Management, System Debugger, Text Editor, Batch Processor and 8080 assembler. Also included in the base price is BASIC-V™, a virtual disk BASIC with the ability to address up to two megabytes.

Price is $995 (plus tax and handling). For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-5317, Neila Richmond.

CIRCLE INQUIRY NO. 127

TERMINALS

PERK for PET

PERK™ (Professional Encoded Remote Keyboard) is a plug-in, typewriter style, alphanumeric keyboard designed to enhance the operation of the Commodore PET with a great variety of applications.

The PERK standard keyboard makes data entry convenient. It shares the PET internal keyboard interface, allowing the two keyboards to be used interchangeably. Both are active at all times, allowing the operator to use the PERK, with its larger size keys, for normal data entry, and PET keyboard for numerics or PET's extensive graphic capabilities.

Introductory price is $229.95 wired and tested. Full instructions, handy reference card, and 90-day warranty are included. For more information contact George Risk Industries, Inc., GRI Plaza, Kimball, NE 69145, (308) 235-4645.

CIRCLE INQUIRY NO. 128

TC-3

The Telephone Cost Control Center, or TC-3, is a high performance Automatic Identified Outward Dialing (AIOD) system. Based upon a

6502 microprocessor, the TC-3 is capable of monitoring and logging both incoming and outgoing telephone traffic on as many as 16 separate lines or extensions simultaneously.

Equipped with a 40 character per line printer and a real-time clock and calendar, the TC-3 prints the following information for each call: Date, Time of Day, Area Code dialed, Exchange and Number dialed, duration of call, Line or Extension Number placing the call.

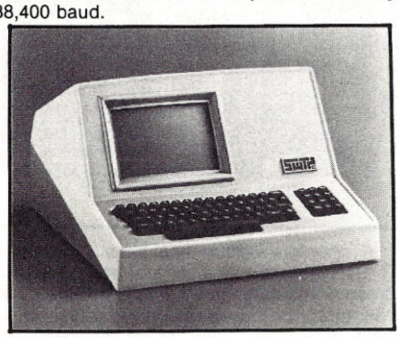
As a management tool, the TC-3 will determine trunk line needs (up or down), peak load analysis, WATS lines requirements, departmental telephone budgets, customer/client chargeback, incoming traffic analysis.

For further information contact BRAG Micro-Computers, Inc., 19 Cambridge St., Rochester, NY 14607, (716) 271-1971.

CIRCLE INQUIRY NO. 129

SWTPC Terminal System

The terminal, designated the CT-82, will work with almost any modem or computer system interfaced RS-232 serially from 50 through 38,400 baud.



The CT-82 features over one hundred control functions operable from either the CT-82's keyboard or the computer's program. With its low price and graphics capability, it's ideal for business or hobby use.

The terminal design utilizes a Motorola 6802 microprocessor and 6845 CRT controller integrated into a modular system which is simple, reliable and easy to service.

The CT-82 is offered in assembled form only and sells for $795 ppd. in the Continental U.S. For more information contact Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX 78216, (512) 344-0241.

CIRCLE INQUIRY NO. 130

I/O CARDS

S-100 Expansion for PET

Forethought Products has available their PET to S-100 Interface/Motherboard "Betsi". Betsi is a single circuit board that contains all the necessary logic to interface S-100 type boards to the Commodore PET.

Unlike other interfaces which require the addition of external chassis, S-100 backplanes, or special cable assemblies, Betsi attaches directly to PET's memory expansion connector and provides both interface logic and four S-100 slots on a single compact circuit board. Betsi operates with any S-100 power supply and doesn't interfere with use of PET's parallel or IEEE ports.

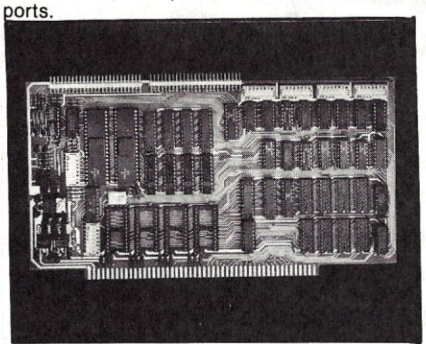
On-board features also include sockets and decoding circuitry for 8K of PROM memory (2716). Future PET software in PROM will plug directly into Betsi with no additional hardware needed.

Betsi is currently available from stock in either kit or assembled form. All parts and full documentation are included at $119 kit (includes one S-100 connector) and $165 assembled and tested (includes four S-100 connectors). For more information contact your local dealer or Forethought Products, 87070 Dukhobar Rd., Eugene, OR 97402.

CIRCLE INQUIRY NO. 131

SWITCHBOARD™

An I/O board for S-100 systems, SWITCHBOARD has four parallel ports and two RS232/TTY serial ports plus strobe and attention ports.



Every port is switch programmable for flexibility in interfacing various types of peripherals. Each parallel port can be switched for input or latched output. Both serial ports can be switched to any of sixteen baud rates from 110 to 19K. Each strobe and attention port flip-flop can be switched for positive or negative pulsing.

Price is $199 kit and $259 assembled. For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-2101, Hilda Sendyk.

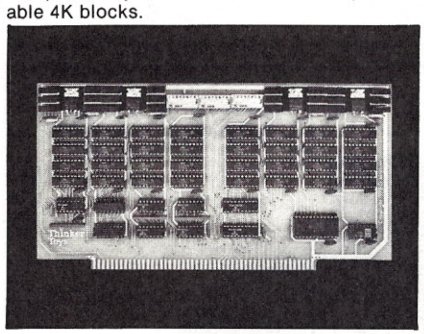
CIRCLE INQUIRY NO. 132

MEMORY CARDS

16K Static RAM

SupeRam™ 16 is a 16K static memory board for S-100 microcomputer systems.

SupeRam 16 is a complete kit featuring four independently addressable and write-protectable 4K blocks.



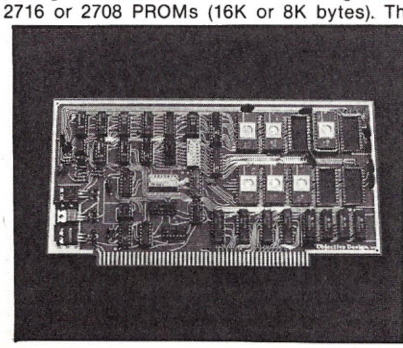
The super-efficient design uses just eleven ICs to keep the board uncrowded and trouble-free. The board was designed to meet the proposed IEEE Standard for S-100, insuring full compatibility with all S-100 systems. All signals are fully buffered, including address and data lines.

Price is $299. For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-5317, Neila Richmond.

CIRCLE INQUIRY NO. 133

S-100 Card Holds and Programs 2716, 2708 PROMs

The DATABANK PROM programming and storage board holds a maximum of eight TMS 2716 or 2708 PROMs (16K or 8K bytes). The



board will also program PROMs via two special sockets. One of these sockets provides a connection to an external programming station while the other socket allows the programming of PROMs on the DATABANK.

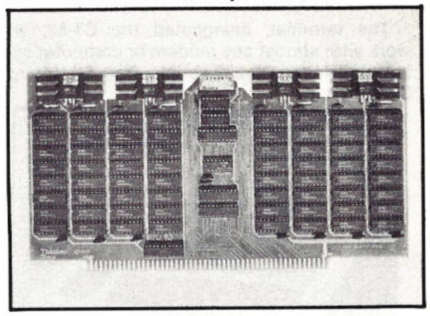
Each of the eight PROMs may be individually switched into or out of the system address space. In addition, the entire board can be disabled and enabled by I/O commands.

The board is available in kit form with or without RAM. For prices and more information contact Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304, (904) 224-5545.

CIRCLE INQUIRY NO. 134

32K Static RAM Board

The SuperRAM™ 32K static RAM board S-100 memory uses the National 5257 or the TI equivalent 4044 4Kx1 NMOS memory chips and can be run at 2 MHz for standard 8080 systems or 4 MHz for Z-80 systems.



A phantom option has been provided for CPUs using this line. All control signals, addresses and data lines are fully buffered. Each 16K block is independently addressable and write protected. This board contains only seven support ICs and the typical power consumption is 2.6 amps.

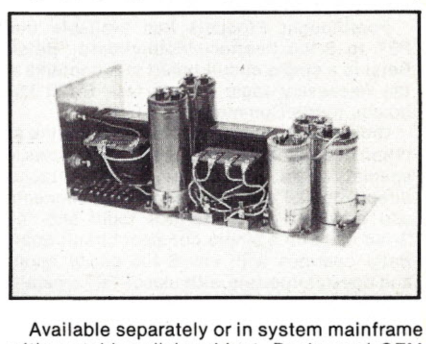
Prices are $649 kit, $699 assembled. For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 524-2101, Hilda Sendyk.

CIRCLE INQUIRY NO. 135

POWER SUPPLIES

The Disk SystemSource

This unit is designed to power not only system mainframes, but also 1-4 disk drives, printers, PROM programmers, etc. DC supply ratings are 8 volts at 24 amps, 16 volts at 4 amps, -16 volts at 4 amps, and 28 volts at 4 amps (to be regulated to 24 VDC for disk drives).



Available separately or in system mainframe with matching disk cabinet. Dealer and OEM inquiries invited. For more information contact Data-tronics, 1671 Timmy Dr., Hamilton, OH 45011.

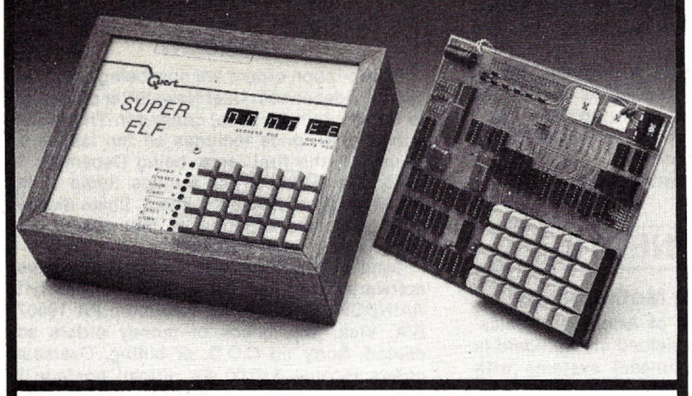
CIRCLE INQUIRY NO. 136

Power Module

Gentron introduces the S Series of POWER-THERM® SCR hybrid circuits. Nine basic circuit types are available with voltages to 1200 volts and currents to 110 amps. Modules offer significant advantages including a low thermal

P.O. Box 4430N Santa Clara, CA 95054
For will call only: (408) 988-1640
2322 Walsh Ave.

Quest ELECTRONICS



QUEST Cosmac Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded** with **additional memory, Tiny Basic, ASCII Keyboards, video character generation, etc.**

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are shown on several LED indicator lamps.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, input, memory protect, memory select, monitor select** and **single step.** Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector for PC cards and a 50 pin connector for the **Quest Super Expansion Board**. Power supply and sockets for **all** IC's are included in the price plus a detailed 90 page instruction manual.

Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and research and development.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Hardwood Cabinet** with drilled and labelled front panel **$24.95. NiCad Battery Backup Kit $4.95.** All kits and options also come completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year.

Tiny Basic for ANY 1802 System

Cassette $10.00. On ROM Monitor $38.00. Super Elf owners, 30% off. **Object code listing or paper tape with manual $5.50. Original ELF Kit Board $14.95.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed** ($12.00 value). EPROM can be used for the monitor and Tiny Basic or other purposes.

A IK Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatible cassette file) another exclusive from Quest. It includes register save and readout, video graphics driver with blinking cursor and block move capability. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. A Godbout 8K RAM board is available for $127.95. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $12.50 for easy connection between the **Super Elf** and the **Super Expansion Board.**

The **Power Supply** for the Super Expansion Board is a 5 amp supply with + 8v ± 18v + 12v − 5v. Regulated voltages are ±5v & +12v $29.95. −12 volt optional. Deluxe version includes the case at $39.95.

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

INTEGRATED CIRCUITS

7400TTL	
7400N	.17
7402N	.17
7404N	.19
7409N	.23
7410N	.17
7414N	.63
7420N	.17
7422N	1.39
7430N	.20
7442N	.50
7445N	.69
7447N	.60
7448N	.69
7450N	.17
7474N	.29
7475N	.49
7485N	.88
7489N	2.00
7490N	.43
7492N	.43
7493N	.43
7495N	.69
74100N	.90
74107N	.29
74121N	.34
74123N	.59
74125N	.39
74145N	.69
74150N	.95
74151N	.69
74154N	1.00
74157N	.69
74161N	.87
74162N	.87
74163N	.87
74174N	.96
74175N	.90
74190N	1.15
74192N	.87
74193N	.85
74221N	1.55
74298N	1.65
74365N	.66
74366N	.66
74367N	.66

74LS00 TTL	
74LS00N	.25
74LS02N	.25
74LS04N	.25
74LS05N	.25
74LS08N	.25
74LS10N	.25
74LS13N	.40
74LS14N	.90
74LS20N	.25
74LS22N	.25
74LS28N	.41
74LS30N	.25
74LS33N	.39
74LS38N	.30
74LS74N	.35
74LS75N	.47
74LS90N	.51
74LS93N	.51
74LS95N	1.89
74LS107N	.35
74LS112N	.35
74LS113N	.35
74LS132N	.72
74LS136N	.35
74LS151N	.67
74LS155N	.67
74LS157N	.67
74LS162N	.91
74LS163N	.91
74LS174N	.95
74LS190N	1.06
74LS221N	1.95
74LS258N	.67
74LS367N	.89

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CA3046	.67
CA3081	1.80
CA3082	1.90
CA3089	2.95
LM301AN/AH	.35
LM305H	.87
LM307N	.35
LM308N	.89
LM309H	1.15
LM309K	.95
LM311H/N	.90
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LM318	1.35
LM320K-5	1.20
LM323K-5	6.95
LM320K-12	1.35
LM320K-15	1.35
LM320T-5	1.60
LM320T-8	1.60
LM320T-12	1.50
LM320T-15	1.60
LM324N	1.15
LM339N	1.55
LM340K-5	1.10
LM340K-8	1.10
LM340K-12	1.10
LM340K-15	1.10
LM340K-24	1.10
LM340T-5	1.10
LM340T-8	1.10
LM340T-12	1.10
LM340T-15	1.10
LM340T-18	1.10
LM340T-24	1.10
LM343H	4.50
LM370	1.15
LM377	4.50
LM379	5.00
LM380N	1.00
LM381	1.60
LM382	1.60
LM703H	.40
LM709H	.28
LM723H/N	.50
LM733N	.67
LM741CH	.35
LM741N	.25
LM747H/N	.62
LM748N	.35
LM1303N	.82
LM1304	1.10
LM1305	1.27
LM1307	2.00
LM1310	2.75
LM1458	.47
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LM1812	7.50
LM1889	3.00
LM2111	1.75
LM2902	1.50
LM3900N	.60
LM3905	1.75
LM3909N	.61
MC1458V	.50
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NE555V	.43
NE556A	.79
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NE566V	1.50
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NE570B	5.00
NE571B	5.00
78L05	.60
78L08	.60
79L05	.70
78M05	.85
75108	1.75
75491CN	.50
75492CN	.55
75494CN	.89

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8750CJ	13.95
LD130	9.95
9400CJV/F	7.40
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CD4000	.16
CD4001	.21
CD4002	.21
CD4006	1.10
CD4007	.21
CD4008	.21
CD4009	.39
CD4010	.39
CD4011	.21
CD4012	.21
CD4013	.36
CD4014	.86
CD4015	.86
CD4016	.36
CD4017	.94
CD4018	.94
CD4019	.21
CD4020	1.02
CD4021	1.02
CD4022	.86
CD4023	.21
CD4024	.75
CD4025	.21
CD4026	1.51
CD4027	.36
CD4028	.79
CD4029	1.02
CD4030	.21
CD4035	1.02
CD4040	1.02
CD4042	.71
CD4043	.63
CD4044	.63
CD4046	1.67
CD4049	.36
CD4050	.36
CD4051	1.13
CD4060	1.42
CD4066	.71
CD4068	.40
CD4069	.40
CD4070	.40
CD4071	.21
CD4072	.21
CD4073	.21
CD4075	.21
CD4076	1.75
CD4078	.40
CD4081	.21
CD4082	.21
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CD4508	4.25
CD4510	1.02
CD4511	.94
CD4515	2.52
CD4516	1.10
CD4518	1.02
CD4520	1.02
CD4527	1.51
CD4528	.79
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CD4566	2.25
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CD4585	1.10
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74C00	.28
74C04	.33
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74C48	1.95
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8096	.65
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2102-1	.95
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2107B	4.95
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MM5314	3.90
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MM5318	3.60
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8216	2.90
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8228	5.35
8251	8.50
8253	10.00
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IC SOCKETS
Solder Tin Low Profile

PIN	1 UP	PIN	1UP
8	.15	22	.30
14	.18	24	.35
16	.20	28	.42
18	.27	36	.58
20	.29	40	.57

3 level wire wrap gold.
14 pin .25 16 pin .27
2 level 14 pin ww .20

WIRE WRAP LEVEL 3

PIN		PIN	
14	.25	24	.86
16	.27	28	1.00
18	.57	40	1.23

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AY5-1014	7.50
3341	6.95

PROM	
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N82S23	2.95
N82S123	3.50
N82S126	3.75
N82S129	3.75
N82S131	3.75
N82S136	8.75
N82S137	8.75
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2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
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5.185 MHz	4.50
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6.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50

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AY5-3600	13.50
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74C923	5.50
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Black	.55	.47

Keyer 8043 14.50
comp. w/spec./sock.

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2N2369	.30
2N2904A	.20
2N2907A	.25
2N3053	.40
2N3638	.25
2N3643	.25
2N3904	.18
2N3906	.18
2N3055	.69
2N4400	.25
2N4401	.75
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100 per type .015   5 per type 6.75

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DL704	CC	.300	1.25
DL707/DL707R	CA	.300	1.00
DL727/728	CA/CC	.500	1.90
DL747/750	CA/CC	.600	1.95
DL750	CC	.600	1.95
FND359	CC	.357	.70
FND500/507	CC/CA	.500	1.35
FND503/510	CC/CA	.500	.90
FND800/807	CC/CA	.800	2.20
3 digit Bubble			.60
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DG8 Fluorescent			1.75
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5500		25V	2.50
5800		40V	3.00
6100		40V	3.00
6100		50V	3.00
7700		50V	2.50
8000		55V	2.50
9400		65V	3.00
10000		20V	2.50
12000		30V	3.50
35000		25V	5.00
55000		25V	5.00
82000		15V	6.00
160000		10V	6.00

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DC clock with 4-.50" displays. Uses National MA-1012 module with alarm option. Includes light dimmer, crystal timebase PC boards. Fully regulated, comp. instructs. Add $3.95 for beautiful dark gray case. Best value anywhere.

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Indoor and outdoor. Switches back and forth. Beautiful. 50" LED readouts. Nothing like it available. Needs no additional parts for complete, full operation. Will measure −100° to +200°F, tenths of a degree, air or liquid. Very accurate. **$39.95**
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CT7015 direct drive chip displays date and time on .6" LEDS with AM-PM indicator. Alarm/doze feature includes buzzer. Complete with all parts, power supply and instructions, less case.

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1978 IC Update Master Manual
1978 IC Update Master Manual **$19.50**. Complete IC data selector, 2175 pg. Master reference guide. Over 42,000 cross references. Free update service through 1978. Domestic postage **$3.50. Foreign $5.00.** 1979 IC Update available late Jan. **$30.00.**

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Full six digit battery operated. 2–5 volts. 3.2768 MHz crystal accuracy. Times to 59 min., 59 sec., 99 1/100 sec. Times std., split and Taylor. 7205 chip, all components minus case. Full instructions.

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DB25S	3.95	DE9S	1.95
Cover	1.50	DA15P	2.10
RS232 Complete Set	6.50	DA15S	3.10

S-100 Computer Boards

8K Static RAM Kit	$127.00
16K Static RAM Kit	265.00
24K Static RAM Kit	423.00
32K Dynamic RAM Kit	449.00
64K Dynamic RAM Kit	945.00
8K/16K Eprom Kit (less PROMS)	**$89.00**
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FREE: Send for your copy of our NEW 1978 QUEST CATALOG. Include 28¢ stamp.

resistance .4° C/W maximum V J-C, isolation and internal interconnects. By using these modules, significant economic and performance gains can be achieved over discrete devices.

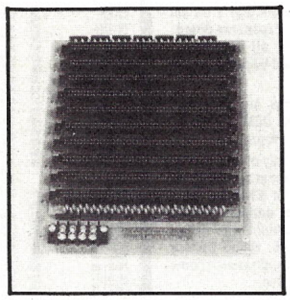
Prices start at $20 each in 100 piece quantity. Delivery is about 3-4 weeks stock. For more information contact Gentron Corp., 6667 N. Sidney Pl., Milwaukee, WI 53209, (414) 351-1660, Lance Kaufman.

CIRCLE INQUIRY NO. 137

COMPONENTS

Silent Ten-Slot Motherboard

This ten-slot version of Artec Electronics' 16-slot, silent, totally shielded motherboard is intended for use in compact systems with large memories. The ten slot configuration allows the processor and peripherals to be condensed into a smaller package, without large amounts of spurious noise in the bus lines.



The board features sturdy, one-eighth-inch FR4 glass epoxy construction and substantial ground traces. It also features Artec's PRC termination technique, which terminates each S-100 bus line in an optimum impedance without increasing the zero-state leading of the bus drivers. The board comes drilled to mount in the Imsai chassis and can be easily drilled to fit other chassis by the user.

Price is $115 assembled and tested in single quantities. For more information contact Artec Electronics, Inc., 605 Old County Rd., San Carlos, CA 94070, (415) 592-2740, Robert Jones.

CIRCLE INQUIRY NO. 138

PCM Line Filter

The Intel® 2912 PCM (Pulse Code Modulation) Filter is a fully integrated line filter for digital telephone systems. The new semiconductor device includes transmit and receive filters, an input amplifier, a 50/60 Hertz notch filter and an independent output power amplifier. It meets the demanding specifications of digital Class 5 central office filters with no external components or frequency response adjustments.

The PCM filter is a companion piece to the CODEC (coder/decoder) which converts the analog telephone signal to digital PCM and vice versa. The filter has two independent sections, transmit and receive. The transmit portion passes the analog outgoing signals that the CODEC should encode and filters any that the CODEC should not encode. The receive portion smooths the analog incoming signals after they have been decoded by the CODEC.

The filter removes extraneous high frequency components, and it corrects the 1000 to 3300 Hertz performance to flatten the voice band frequency response of the system. The input amplifier for the transmit section and an independent power amplifier for receive minimize the number of extra components required to build a complete system and permit independent gain adjustments in each direction.

The 2912 is packaged in a standard 16-pin DIP and priced at $22.80 in 100 piece quantities. For more information contact Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051, (408) 249-8027, Rob Walker.

CIRCLE INQUIRY NO. 139

LITERATURE

RAINBOW

Subscription orders are now being accepted for the independent User Newsletter dedicated to the Apple II personal computer. The $15.00 subscription price includes all ten issues of volume 1, the first issue being December 1, 1978. The Rainbow will include items of interest solely to Apple II owners. Share discoveries, programs, experiences, innovations, and anecdotes — internationally.

Send subscription orders, articles, letters, software (for review, exchange or sale) to THE RAINBOW, P.O. Box 43, Audubon, PA 19407. B/A, Visa, MC, check or money orders accepted. Sorry no C.O.D. or billing. Overseas orders include $10.00 for airmail postage if desired. For more information write to same address given above.

CIRCLE INQUIRY NO. 140

Worldwide FAX Standards Explained

A booklet for fax users called *Understanding Facsimile Communications Standards* explains international compatibility standards. The booklet provides history, background, and the details of international digital (or "group 3") facsimile communications standards recently recommended by the study group of the United Nation's Consultative Committee for International Telephone and Telegraph. These standards (expected to be confirmed at CCITT's 1980 plenary session) will facilitate communications between digital equipment made by many manufacturers in many countries, and will play an important role in making digital facsimile a universal communications device.

This convenient, envelope-sized booklet includes definitons for facsimile "groups", and Group 3 recommended standards for paper size, scanner and resolution, codes, modems, and handshake protocols, as well as discussion of the significance and present status of the standards.

The booklet may be obtained from Product Management, Graphic Sciences, Inc., Corporate Drive, Commerce Park, Danbury, CT 06810, (203) 792-6000, Ext. 230.

CIRCLE INQUIRY NO. 141

SOFTWARE

8080 Checkers

TCD Incorporated has a checkers program that is capable of playing a very challenging game of checkers. The program can be set to play at two levels of difficulty (four and six move look ahead).

At level four the program will respond in less than four seconds and at level six the program will typically respond in less than 60 seconds and rarely more than 120 seconds.

An interesting feature is that it randomly selects between equal moves — some that have beaten it once, cannot duplicate their feat.

The checker board is imaged on the video display using the full height of the screen and ¾ the width thus allowing play without a separate checker board.

Hardware required is an 8080/Z-80 computer with 12K RAM and a memory mapping display such as SOL, VDM-1 or TRS-80. The software is distributed on CUTS cassette tape (orged at 0) and on North Star diskette (orged at 2A00H).

Prices are $19.50 for cassette and $24.50 for diskette with generous discounts available to dealers. Documentation includes all the necessary patches to allow 8080 Checkers to run on any system meeting the above hardware requirements and will run on a SOL as shipped.

For more information contact TCD Inc., P.O. Box 58742, Houston, TX 77058, (713) 486-0291.

CIRCLE INQUIRY NO. 142

Network Software for DECSYSTEM-20

DECnet-20 network software for the DECSYSTEM-20 family of computer systems, enables users to interconnect all major Digital computers and operating systems.

DECnet-20 is based on Digital Network Architecture protocols and runs under the TOPS-20 operating system. It permits task-to-task (program-to-program) communication between a DECSYSTEM-20 computer and any adjacent network node—another DECSYSTEM-20, a VAX-11/780 system or PDP-11 computer. DECnet messages sent and received by the user programs can be in any data format.

DEC-net-20 software price is $5,000 for a single-system license fee. For more information contact Digital Equipment Corp., Maynard, MA 01754.

CIRCLE INQUIRY NO. 143

QuickTax Individual Tax Return Program for 1978

This system will calculate and print out all figures and taxes for the following government tax forms and schedules: Form 1040A, Form 1040 which includes Schedule A, Schedule TC, Schedule G, Schedule R, Form 4625, Form 3468, Form 4726. Programs are also available for Schedules B, C, SE and Form 2210.

The QuickTax programs are written in Micropolis BASIC and require a computer with a minimum of 48K memory, a Micropolis Mod II disk drive, and printer. Programs are supplied on diskettes, and include documentation and instruction manual.

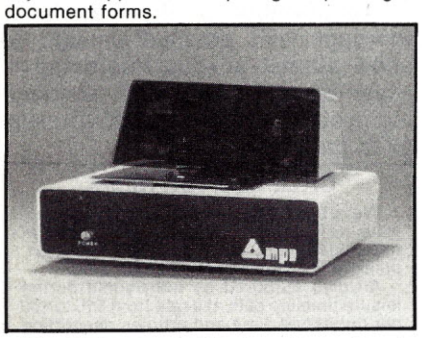
The system cost will be between $250 and $500, depending on the number of schedules ordered. For more information contact QuickTax, A Div. of J.A. Abbott, Inc., 60 Mason St., Staten Island, NY 10304.

CIRCLE INQUIRY NO. 144

MISCELLANEOUS

TP-40 Ticket Printer

The TP-40 Ticket Printer is designed for POS terminals, weighing systems, ticket printing or any other application requiring the printing of document forms.



The printer uses a 40-column impact mechanism which prints a 64 character ASCII alphanumeric set in a 5x7 dot matrix pattern. The microprocessor controlled serial interface can accept either RS232C or 20MA current-loop data at any of 8 selectable baud rates, ranging from 110 to 9600.

The complete TP-40 Ticket Printer is priced at $599 in quantities of 100. The mechanism and interface assembly without casework is $460 in quantities of 100. Delivery is 2-6 weeks ARO. For more information contact Micro Peripherals, Inc., 2099 W. 2200 S., Salt Lake City, UT 84119, (801) 973-6053.

CIRCLE INQUIRY NO. 145

New Dust Covers Protect Equipment

Cover Craft has a new line of high quality protective dust covers to fit all popular brands of computers and peripherals.

Hundreds of sizes are available, each designed to precisely fit a specific model. Keeping components clean and dust free will greatly extend the useful life of costly equipment.

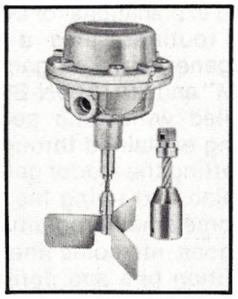
Each cover is custom designed then hand cut from high quality textured flexible vinyl. All seams and edges are machine stitched for maximum strength.

For more information contact Cover Craft, P.O. Box 555, Amherst, NH 03031, (603) 673-8592, David Mackey.

CIRCLE INQUIRY NO. 146

Adapt-A-Flex Coupling

The new Adapt-A-Flex coupling adds versatility, convenience to the line of paddle type automatic bin level indicators produced by Monitor Manufacturing.



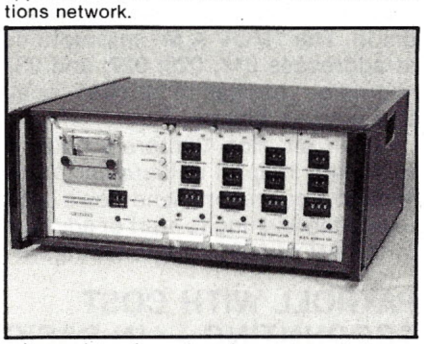
The Adapt-A-Flex unit threads directly into the short, solid shaft of all Monitor paddle type bin level controls now being produced. The user can change — in the field — from a solid shaft to a flexible shaft without changing the seal, basic coupling assembly or paddle.

For more information and prices contact Monitor Manufacturing, Drawer AL, Elburn, IL 60119.

CIRCLE INQUIRY NO. 147

Communication Monitoring System

The Model 500 Data Communications Performance Monitoring System is a user oriented approach to the evaluation of a communications network.



It consists of a series of modules which capture specific information about the communications line and then presents that information in a statistical format.

The system uses a modular concept so that it can be configured to each user's needs. The power supply is sufficient to power the printer and 11 additional modules.

For more information contact Questronics, Inc., c/o Ross Clay Advertising, 1390 S. 1100 E., Salt Lake City, UT 84105.

CIRCLE INQUIRY NO. 148

BOOK REVIEWS

8080 MACHINE LANGUAGE PROGRAMMING FOR BEGINNERS

by Ron Santore
dilithium Press, 1978. $6.95

Review by Jesse Chisholm

Ron Santore designed this book to be a step-by-step guide into the basics of machine language programming. As a novice to the 8080, I found the reading enjoyable and informative.

Santore starts the book by giving a background on how the computer operates and introduces the logical terms used in the book. The introduction finishes by giving a short program and telling the reader how to enter it into the machine.

Santore then gives detailed programs and explanations for INPUT and OUTPUT routines, plus a random number generator. The games "HI-LO", "NIM" and "BUTTON-BUTTON" are detailed with each section of code being explained throughout.

After letting the reader get used to the machine and trying his hand at writing some small programs for the 8080, he goes into some finer details like condition bits and defines several OP-CODES. But these definitions of two codes are missing: the RAL (027), a rotate ACCUMULATOR left into the CARRY bit, with the CARRY bit shifted into bit 0; and RAR (037), a rotate ACCUMULATOR right into the CARRY bit, with the CARRY bit shifted into bit 7.

In the appendixes, solutions to the program the reader is asked to write are given, with discussions of each logical section.

There is an error in his "Better Random Number Generator" (Appendix II). The "MOV A,M" instructions at addresses 017; 023; 027; and 033 should be changed to "XRA M" or all this work is wasted.

All in all, Ron Santore's book is extremely helpful in learning to use an 8080. I can recommend Ron's book to anyone wishing to start or advance in the Art of 8080 Programming.☐

PAYROLL WITH COST ACCOUNTING — IN BASIC

By Lon Pool and Mary Borchers
Osborne & Associates. $12.50

Review by Roger Edelson, Hardware Editor

This book is basically a list of programs. It is not a book on how to write programs; the programs are already here and waiting. However, it is not a cookbook either, since the programs are specifically written for the WANG Laboratories 2200 series computer using its special extended BASIC.

What this book does is present 35 programs which together form a payroll and accounting system for one specific computer. What makes this book useful to persons other than those with the particular computation system described is that the programs are in BASIC, and the program capabilities, limitations and flexibilities are analyzed. The discursive material is complete enough that a potential user having a prior knowledge of programming and a familiarity with payroll procedures should be able to easily make the necessary program modifications. While making the modifications necessary to run this program on your own system, you should consider customizing them for your specific application.

This book, printed using the boldface/lightface type system that is almost a trademark of Osborne publications is extremely readable. The lightface type is used to expand on the information presented in the previous boldface type. This makes it possible to skim along through the boldface type until you reach a subject you wish to know in more detail, then shift to low gear and start reading the lightface type.

The coverage of the material is thorough and detailed enough to allow almost anyone interested in assembling a payroll/cost accounting system to make use of the supplied programs.☐

CALL FOR ARTICLES

We are actively seeking articles in hardware, software and general applications of microcomputers in industrial, business, science, medicine and personal fields.

Articles authored by individuals during leisure time are paid at a rate from $15 to $50 per published page and articles describing company projects carry author and company byline, but no honorarium is offered. Articles accepted will be acknowledged with a binder check within 30 days of receipt.

Manuscripts should be double-spaced, typewritten pages, one inch margins, and not less than 3½ pages in length (one published page). Pages should be numbered to insure correct text. Photographs should be numbered and labeled on the back with a description. Photos should be taken with uniform lighting and background in the form of glossy black and white prints. Tables, listings, etc., shall be on separate sheets. Computer listings must be printed using a new ribbon to assure darkest print copy.

The publisher assumes no responsibility for artwork, photos, models, or manuscripts. Manuscripts are not acknowledged or returned unless accompanied by an addressed, stamped, return envelope.

For article submittal or further information, contact Carl Warren, Senior Editor, INTERFACE AGE Magazine, 16704 Marquardt Avenue, Cerritos, CA 90701.

Programming Technique - Night 1

By Bill Turner, Senior Editor Southeastern Region

This series of articles will attempt to teach the techniques of machine language programming and of system design, documentation, and implementation.

The articles will focus on the use of the 8085 made by Intel, and the Motorola 6800. Other microprocessors will also be discussed as time and space permit.

The series will be written in a tutorial format designed to improve your knowledge of computers and their proper use. If you have any problems understanding the material presented, please write. I am not promising to answer every letter with a return reply, but every effort will be made to do so.

COMMON MISCONCEPTIONS

While it is true that with the use of a computer a single worker can quite often perform the same amount of work done by several workers, it is not correct that those other workers will be fired because of the computer. Usually, businesses handle the manpower overflow by not hiring any replacement employees as older employees either transfer out or quit. Consequently, over a period of time, the same office staff is handling a much greater volume of work, yet each worker is still working the same hours with about the same work load.

Displaced employees are often transferred into other areas of the company and frequently receive new training. With the new training, these employees become far more important than they were in the 'old' job.

Computers very seldom reduce the entire work force of a company — in fact the use of computers sometimes causes employees to be added to the payroll. After all, someone has to be responsible for the care and feeding of the machine.

The mistake that many businesses have made in the past was to hire computer experts to run the business, rather than have the existing in-house business experts learn how to use the computer. However, there is a need for computer experts to keep both the computer system and data-processing department running at top efficiency. But there is a greater need for the "end user" to know more about the capabilities and proper use of a computer *in the framework of his or her department or business.*

With the advent of microcomputers, the cost of the computer equipment (hardware) has gone down to the point that even small business can make use of data processing. Hardware acquisition (cost) is no longer the major stumbling block that it used to be. However, software costs are very real. Because of the very nature of software (computer programs), this can be a very difficult cost to control.

It has been said that a computer can be programmed to do any problem that can be *defined.* The key word here is *defined,* which means that the solution of the problem can be broken down into a series of steps that can be written as a sequence of computer instructions. This *definiton* of the problem, before any programming is started is very important, for without the *definition* no solution can be made. As you can well guess, the *definition* of some problems can be exceedingly difficult.

As an example, quite a few years ago, it was thought that translation of German into English would be fairly easy task. After all, all it takes is a very large dictionary containing one-word definitions.

You would read a line of text in German, find the first word, look it up in the dictionary, and output the dictionary definition . . . Right? — **Wrong.** As it turns out, to translate word for word *is* very easy, but it is very difficult to precisely translate sentences because of the many shades of meaning associated with individual words and word combinations.

Not too many years ago, there were two different groups of programmers working on natural language translation — one group was translating English to German, and the other German to English. Furthermore, they were only interested in translating technical information. There was no desire, at that time, to translate works of literature.

When they were both finished with their programming development, it seemed only natural to test both programs at the same time. They did this by taking an airplane maintenance manual written in English, first translating it into German, and then translating it back to English.

After the translation was done, an aircraft mechanic who was acting as a proofreader said: "Although the English was slightly 'stilted,' it was fairly easy to understand. . ." This was until he got to a particular chapter in the manual that was loaded with references to a "water goat." "Water goat? Just what does an aircraft have to do with a water goat?"

The various programmers and linguistic experts scratched their heads and puzzled over that one for a while. Finally they decided that they better check the original input for errors.

"Water goats!" one of the technicians yelled, while he doubled over laughing. "It should have been 'Hydraulic Rams'. . ."

The moral to that story is that data taken out of context usually has no meaning at all. The research projects in natural language translation have proved that language

translation must be done in context by translating phrases rather than translating word by word. Language translation is now being done with a very high degree of accuracy, but it is not as easy as once thought.

You will probably agree that natural languages are not practical for use in communicating with a computer at this time because there are too many ways of saying the same thing. For instance, the phrase "two and two equals four" means the same thing as "two plus two is four." The words "and" and "plus" mean the same in this sentence, but not in the dictionary. The same is also true of the words "is" and "equals."

While natural languages are impractical for man/machine communications, programming languages such as FORTRAN, ALGOL, COBOL, PL/I, BASIC and literally hundreds of others, are suitable for man/machine communication. These artificial or programming languages have a precisely defined structure and syntax, which greatly simplifies communication with a computer.

Most programming languages are problem oriented and are designed to use familiar words and expressions. Therefore, by using a programming language it is possible to learn to write programs after a relatively short training period. For instance, in BASIC the key word "PRINT" is used to instruct the computer how to print the results of the calculations on paper. Likewise "IF" is used to ask a question (IF A = 1 THEN . . .)

WHO CAN BE A PROGRAMMER?

Who can be a programmer? Valid question. In the early days of computer programming, almost all programmers were mathematicians. This was because most computers were being used by the mathematicians as giant calculators.

However, as you will discover over the next few months, most programming requires only an elementary ability to handle arithmetic and logical operations. But the single most basic requirement for programming is the ability to reason logically.

Why logically? The answer is quite simple: ". . .a computer can be programmed to do any problem that can be *defined*. . ." It generally takes some logical thinking to be able to totally define the problem.

COMPUTER CAPABILITIES AND LIMITATIONS

A computer is a machine and, as all machines, it must be directed and controlled in order to preform a useful task. Until a program is written and stored in the computer's memory, the computer "knows" absolutely nothing, not even how to read information into its memory from the outside world. Thus, regardless of which computer you are using or how good that machine may appear to be, it must be "told" what to do. The usefulness of a computer therefore cannot be fully realized until the capabilities and the limitations of the computer are recognized. In addition, it must be realized that one particular computer may be better suited for a particular task than any other computer.

"Better suited" is generally a result of the internal structure or architectural design of that particular machine. A machine that has a multiply instruction is better suited for some calculations that a computer that must use a series of re-iterative adding instructions. It should be obvious that the single multiplication instruction would operate or execute faster than would the re-iterative addition loop.

FIVE BASIC CONCEPTS

There are five basic concepts that must be kept in mind when working with computers:

1. Repetitive Operation — a computer can perform similar operations thousands of times, without becoming bored, tired, or careless.
2. Speed — A computer processes information at enormous speeds which are directly related to the ingenuity of the designer and the programmer. Modern computers can solve problems millions of times faster than a skilled mathematician.
3. Flexibility — General purpose computers may be programmed to solve many types of problems.
4. Accuracy — Computers may be programmed to calculate answers with a desired level of accuracy as specified by the programmer.
5. Intuition — A computer has no intuition. It can only proceed as it is directed. A man may suddenly find the answers to a problem without working out the details, but a computer must proceed as ordered.

There will be times that a computer will appear to have intelligence, but this is really just the result of the computer following logical steps set up by many different programmers. One programmer will program the computer to handle a specific task, another will provide the necessary instructions for some other task. Frequently, when processing the data for what appears to be a third task, the computer will find it necessary to use the logic steps that were set up for the first two tasks. It could be that the instructions provided for each of the two tasks taken separately would cause different logic paths to be followed than would occur when the two tasks are taken together, thus giving the semblance of intelligence.

DEFINITIONS

As stated earlier, we will be discussing two microcomputer systems in particular: the Intel 8085 and the Motorola 6800. When necessary, references will be made to the rest of the 6800 and 8080 families of microcomputers, but the primary emphasis will be the 8085 and 6800.

Those of you who own systems using the Zilog Z-80 or the Signetics 6502 MPU's should have no difficulty in translating the techniques. (The Zilog Z-80 is an extended 8080, and the 6502 is very similar to the 6800.)

JUST WHAT IS A COMPUTER?

A computer is not just one machine, but in fact is usually a group of machines. One machine is really the central processing unit (CPU) and it usually houses the working part of the computer.

Contained within the chassis of the CPU is the arithmetic and logic unit, the instruction decode circuitry and the necessary logic to access the machine's memory. In a microcomputer, all but the memory is contained within a single integrated circuit (IC) called a microprocessing unit or MPU. The low cost of a microcomputer can be attributed to the fact that these MPU's can be manufactured in high volume for a relatively low cost. Generally the rest of the circuitry contained within the CPU's chassis is the memory, circuitry for addressing the memory, and some specialized circuitry used to connect the CPU to the "real world."

This interface circuitry to the real world is generally referred to as an I/O port. "I/O" means input and output, and I/O ports come in two types — serial and parallel. This serial and parallel terminology has reference to the timing of the signals to each other when data is being transmitted into or out of the CPU. But we are getting ahead of ourselves, more on I/O ports later.

The other boxes or machines that generally make a CPU into a full fledged computer is the actual input and output equipment, as well as some forms of auxiliary memory or storage devices, like tape or disk devices.

A simple terminal (either a typewriter-like device that will print on paper or a CRT which displays data on a

television set) is actually two I/O devices in one. The keyboard is an input device, the printer or television is an output device.

All computers must have at least one input and one output device. It is also very handy to have some form of auxiliary storage to be able to save programs when the computer is turned off. The most common device used for auxiliary storage in the minicomputer field is a paper tape reader and punch.

In the microcomputer field, the most common device is a regular, garden variety cassette recorder. Most of the microcomputers on the market today have a special device which is used to convert the ON and OFF data pulses that the computer uses into audio tones that can be recorded on tape. The same device generally has the ability to convert the audio tones previously recorded back into "data pulses" when you manually place the cassette recorder into play. (Most cassette tape systems are not suitable for storing data, because of the manual operator interaction that is required.) A floppy disk, on the other hand, is becoming a very suitable storage device.

If your microprocessor system is going to be used primarily for business applications, a floppy disk will become an absolute must. The floppy disk is very useful for storing both data and for maintaining a program library. Later on in the course we will be talking in much greater detail about tape vs. disk.

There is one terminal I would like to identify at this point, because it can be used for auxiliary storage as well as being used as an I/O device for an operator. This is the Teletype Corporation Model 33 or 35 Teletype™. The two machines are functionally equivalent, except the Model 35 was designed for 24-hour-a-day, seven-day-a-week operation; the Model 33 is a lighter duty device. The Model 33 is more common and basically comes in two styles: the KSR and the ASR. The KSR has only a keyboard and printer (KSR = Keyboard Send and Receive). The Model 33 ASR (Automatic Send/Receive) teletype has a 10 character per second (CPS) print speed, a keyboard for operator entered data, a paper tape punch for permanent storage of programs and data, and a 10 CPS paper tape reader. And all of this sells for $300 to $1,000, depending on whether it is used or new.

This brings up an interesting phenomenon in the field of microcomputers — your CPU will cost between $1,000 and $1,500 fully loaded, and peripheral equipment (I/O equipment) can cost as much as 2 or 3 times that! The point is, the CPU represents only about 25 to 50% of the cost of the hardware that you will eventually end up owning. The total hardware costs will only be about 25 to 50% (or even less) of the total cost of any application cost — manpower is expensive, and it does take manpower to program a computer. This is one of the many items that you must take into consideration when designing a new computer applications.

The development costs can then be compared with the cost of doing things the way you currently do them — now you have enough data to make a decision on whether or not a particular process should be automated.

From the above discussion you can see that there is really more to learning programming than just creating programs. A knowledge of costs and application definition are equally important. With this introductory information in mind, we will get into the heart of the matter next month with some definitions of BITS, BYTES, MEMORY, and getting information into and out of the computer. □

Bill Turner can be contacted by writing to: Bill Turner, Senior Editor, Southeast Region, 3316 San Luis, Tampa, FL 33609.

PROGRAMMERS CONTEST

INTERFACE AGE Magazine has a contest for all programmers — professional or hobbyist. The contest is to write a game based on the new television show Battlestar Galactica.

The prizes include: a two-year subscription to INTERFACE AGE and the publication of your game paid at the prevailing author rates.

HERE ARE THE RULES:

- The game must be written in assembly code for any machine of your choice.
- The game must include all the prime characters in the television show.
- The game cannot be based around ships shooting ships.
- The game can utilize graphics at the start and throughout the game.
- The accompanying article must include how to play the game, and exactly how the code works.

Each submitted game will be judged on creativity, coding style, clarity of the game instructions, and how the code works.

DEADLINE AND SUBMITTAL FORMAT

All submittals must be received at the INTERFACE AGE editorial offices not later than April 1, 1979. Each submittal must be accompanied by a self-addressed stamped envelope and an IAPS formatted tape of the code. The tape must contain both source and object code. The article must be in the format described on page 32a of the March 1978 issue.

Send your entry to Carl Warren, Senior Editor, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, California 90701. Please no phone calls.

Designing the Lakeland Repeater (WR4 AWJ) Control and Identify Program

By Bill Hunsicker (K4DF/W5HKM)

An old college friend, George P. Burdell, dropped by to see me not too long ago. After trading a few amenities, we began discussing computer applications.

"Bill, I had an idea about using a microcomputer to run the Lakeland Amateur Radio Repeater."

"I knew it! OK, I can give you some of what you want, but just what are we setting out to accomplish? In other words, what are our goals? Here, let me show you what I mean." I then wrote 9 goals on the blackboard:

GOALS

1. Recognize input signals. (COR and others later on)
2. Control the repeater transmitter.
3. Keep accurate time. (transparent to current operations)
4. Perform ID on a time scheduled basis.
5. Maintain and update internal timers.
6. Provide windbag, tailgate and transmitter time-out control.
7. Provide tone-modulated code. (also transparent)
8. Provide a "Kerchunk" filter.
9. Provide for future growth. (Phone-Patch, etc.)

I said, "The next thing we should do is to define the steps that need to be accomplished."

George interrupted me. "Then we need to develop a flow chart, write the program, develop the hardware. . ." Our list grew to a total of eight items.

STEPS TO ACCOMPLISH

1. Develop list of goals.
2. Develop Flowchart.

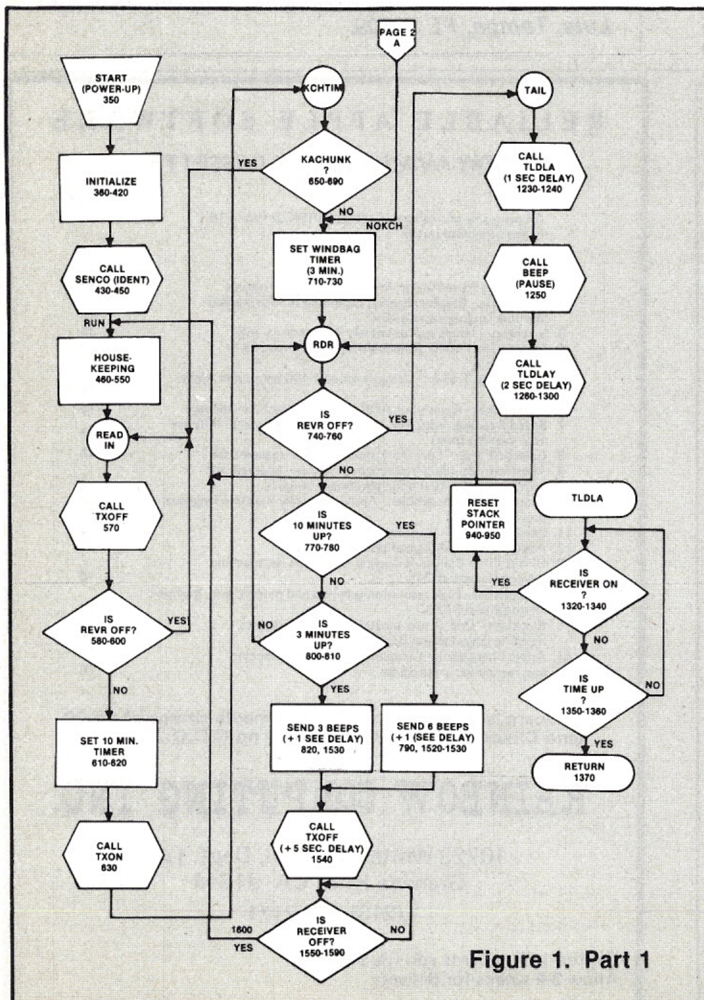


Figure 1. Part 1

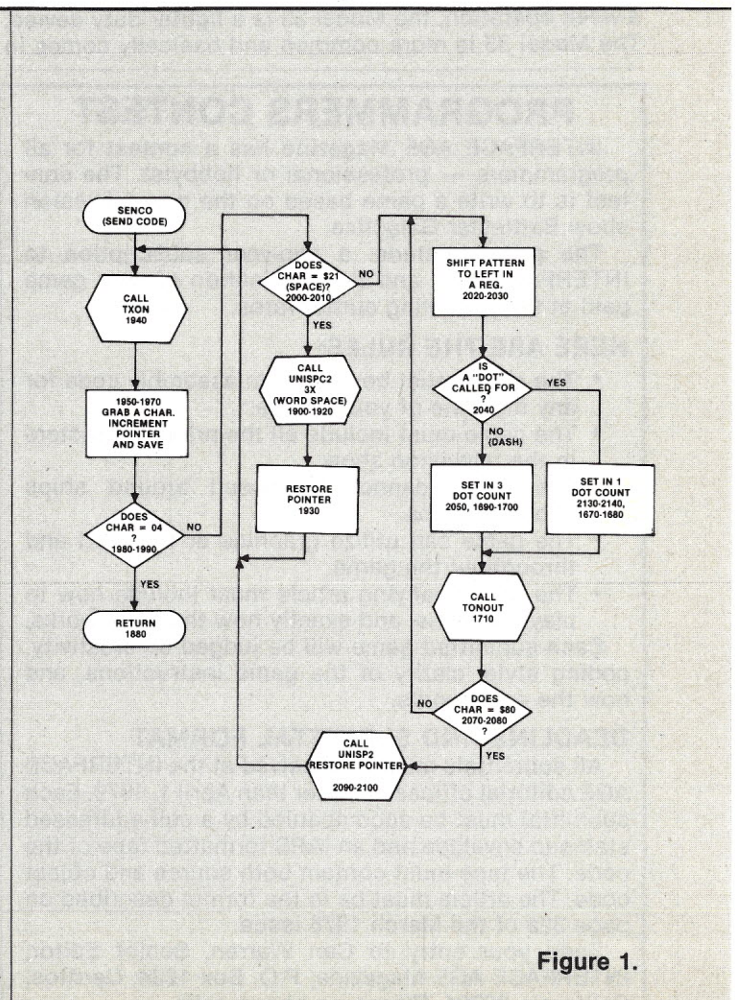


Figure 1.

3. Write the program and develop hardware circuit.
4. Simulate and debug the software and hardware.
5. Convert the software to firmware (EPROM).
6. Build hardware.
7. Connect to Repeater.
8. Plan enhancements.

"Now that we have come this far, George, we have reached a milestone. We have done the preliminary planning. I anticipated a request like yours; steps 1 through 5 of the 'steps to accomplish' have already been done!"

"Here is a copy of the assembled program listing (Program 1), and the schematic (Figure 1). Now then, if you will take the program to your friendly microcomputer store, have them program a 2708 EPROM for you and then build the circuit I gave you, you are almost home free."

"Hey, that's fantastic, Bill. It's more than I had even hoped for. But I'd like to know how this thing works. Suppose it sent the code too fast or too slow, or that the call letters have to be changed? What about. . ."

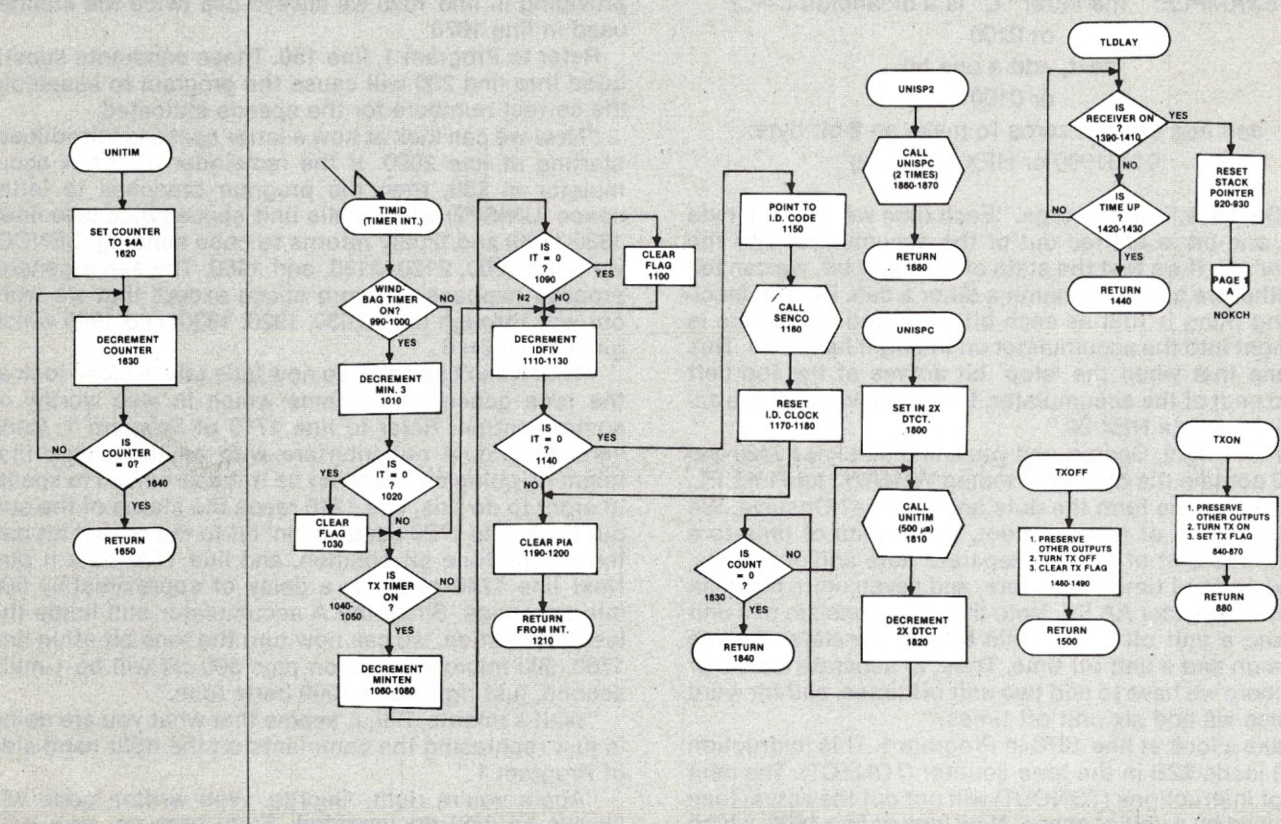
"Thought you'd never ask, George. The main program starts at the label START where system initialization is performed. Once the system has been initialized, the computer will fall into a loop at label READIN (lines 570-600) where the transmitter will be turned off. The system will then wait for an indication that the receiver has detected a carrier (HEX bit 01). After a carrier has been detected, the computer will proceed to set the ten minute timer (maximum transmitter on-time) and to turn the transmitter on. While the transmitter is keyed, the operational loop at RDR (lines 740-810) is in control of the system.

"There are two main support routines in the program. One of the main subroutines is TIMID, which is the time keeping routine activated by the hardware clock ticks. The other subroutine is SENCO, the code sending routine.

"First off, let's see how the code is sent. Before SENCO is called, the index register (line 1150) is pointed at the code buffer IDENT. The transmitter is turned on at line 1960, the first byte is loaded into the A accumulator (line 1970), and then the index register is incremented by one and saved. Now we check to see if the A accumulator contains the terminator for sending code (end of transmission is a hexadecimal 04). If it does, we go back to the caller; else we check to see if it is a space between words (HEX 21).

"If it was a word space we do a WRDSPC; if not, we do an arithmetic shift left, push the A accumulator on the stack (to save it) and check to see if there is a carry. If there is a carry, we transmit DAH (dash); if not, we transmit a DIT (dot). Next we retrieve the value we saved in the stack and put it back into the A accumulator. If the character was a HEX 80, we transmit a letter space and re-enter the routine at SENCO. If the character retrieved was not a HEX 80, we do another arithmetic shift left (ASL), and so on.

"Let me show you how to construct a code message. You see, we let zeros be dits and the ones be dahs, all to be followed by a one."



Part 2

Figure 1. Part 3

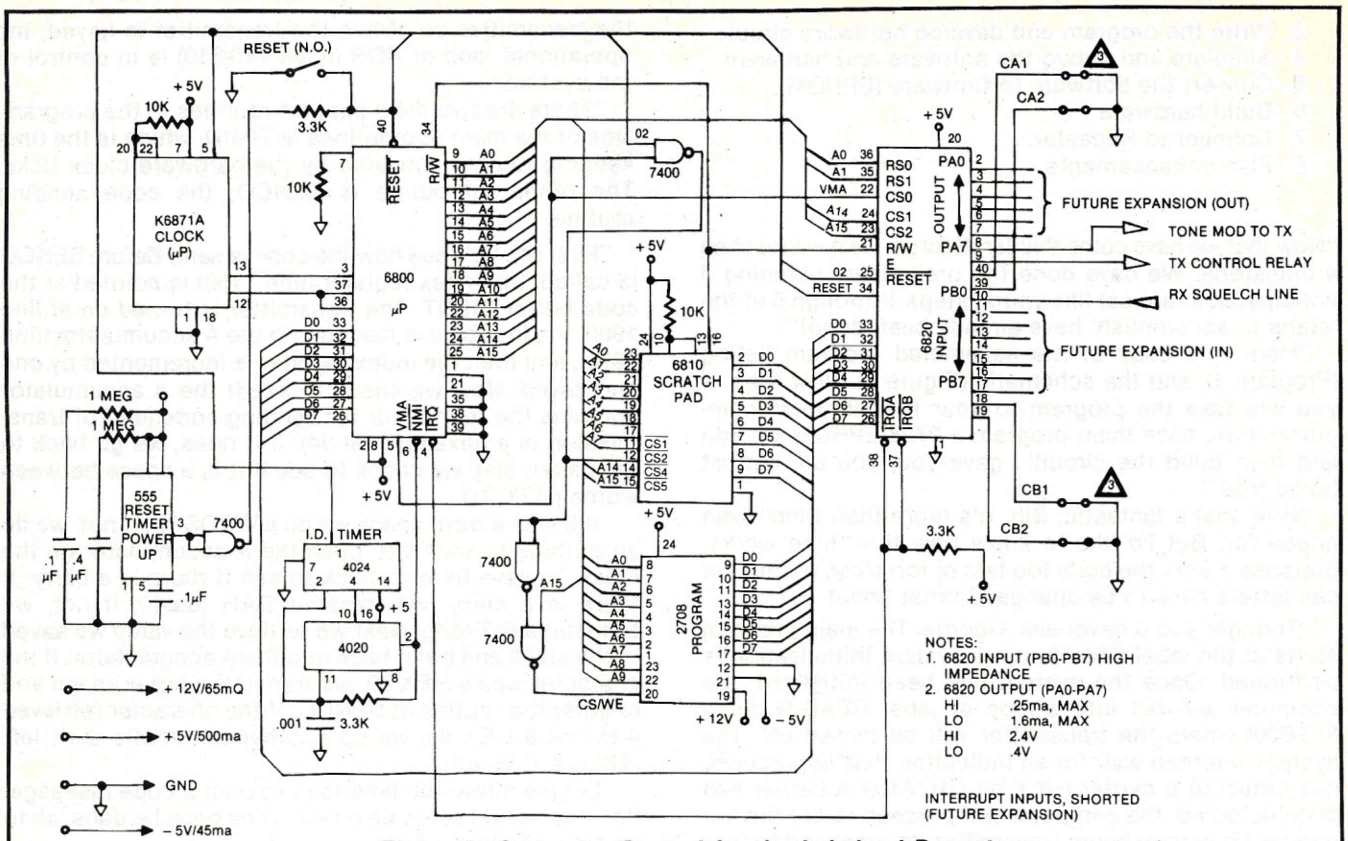


Figure 3. Computer Control for the Lakeland Repeater — WR4AWJ.

EXAMPLE: the letter "L" is a didahdidit (.—..)
or 0100
next, add a one bit:
or 01001
and add enough zeros to make an 8-bit byte:
01001000 or HEX 48 ($48)

"Oh, I see," said George. "Each time we shift the byte left, one bit is shifted out of the accumulator into the 'carry' bit. If we test the state of the carry bit, we can tell whether we should transmit a dit or a dah. But the fascinating thing is that as each bit is shifted left, a zero is brought into the accumulator on the right hand end. This means that when the 'stop' bit arrives at the top (left hand end) of the accumulator, the actual value of the accumulator is a HEX 80."

"That's right, George, and you'll find that lines 2420 and 2430 contain the data for sending WR4AWJ and LKL FL.

"How do we form the dots and dashes? Observe. We assign a unit of time to a dot, three units of time to a dash, one unit of time to separate dots and/or dashes, three units of time characters, and seven units between words. Consider AA EE. Note that a dit consists of a unit on and a unit off time, while a dash consists of three units on and a unit off time. Thus, to separate letters or numbers we have to add two unit off times, and for word spaces we add six unit off times."

Take a look at line 1670 in Program 1. This instruction (DIT) loads $2B in the tone counter (TONECT). The next set of instructions (TONOUT) will put out the actual tone followed by a unit of space. Now look at line 1690, which loads $81 in the tone counter and then branches to TONOUT to put out the actual tone. The ratio of $2B to $81 is 1 to 3 (43 to 129 decimal). As long as this ratio is maintained, the code should be perfectly proportioned, providing in line 1800 we always use twice the number used in line 1670.

Refer to Program 1, line 150. These constants substituted into line 230 will cause the program to assemble the correct numbers for the speeds indicated.

"Now we can look at how a letter space is introduced, starting at line 2090. If the remainder of the A accumulator is $80, then the program branches to letter space (UNISP2) which calls unit space twice (see lines 1880-1890) and finally returns to code sending (SENCO) via lines 1900, 2120, 2130, and 1960. The same general process happens for word space except that we work our way through lines 2030, 1920, 1930, and 1940 which gives us 3*2=6.

"That wasn't so hard, so now let's take a close look at the tone generation scheme which is also worthy of some mention. Refer to line 1710 of Program 1. Code sending should not interfere with anything else that might be going on; it should be transparent, so to speak. In order to do this, line 1710 reads the status of the output lines, line 1720 adds an 'on' bit to the output bit pattern in the tone bit position, and line 1730 puts it out. Next line 1740 goes for a delay of approximately 500 microseconds. Since the A accumulator still holds the last information, we can now turn the tone bit off in line 1760. 500 microseconds on plus 500 off will be 1 millisecond, just right for a 1000 hertz tone."

"Wait a minute, Bill, it seems that what you are doing is just rephrasing the comments on the right hand side of Program 1."

"Again you're right, George. Well written code will always be well documented. From here on, let's only refer generally to Program 1, and you can read it for yourself. Let's examine the UNISPC delay loop and the 500 microsecond delay loop.

"Line 1820 seems to infer that we need a space twice as long as a dit. Actually, a dit is turned on for 500 microseconds and then off for 500 more. Therefore, to equal the length of a dit, we must have two 500 microsecond delays for each dit count (DTCT). Thus, we use lines 1820 through 1860 to obtain a delay equal to a dit time.

"The 500 microsecond delay loop, on the other hand, is a little more sticky and is the basis of most of our delays. The crystal clock assumed is approximately 1.797 Mhz which makes each machine cycle approximately 1.113 microseconds long. If we trace the program from line 1620 through lines 1630, 1640, 1650 and back, we will have consumed 445 machine cycles. 445*1.11 microseconds per machine cycle is approximately 495 microseconds."

"Bill, if all the timing is developed by your 500 microsecond delay loop, why on the schematic (Figure 1) do you have a 4024 and 4020 identified as a ID TIMER? It seems to be attached to the 6800 NMI input. Isn't that being used as a 'timer' of sorts?"

"There are two general types of timing employed by the program. One we have just examined is related to the system master crystal controlled clock to generate the 500 microsecond delays. There is another form of timing that depends on a hardware clock. The reason is, if we tied the CPU up in being a software clock, it would be hard-pressed to do anything else. Note that the 500 microsecond delays are when it is doing a specific chore (sending code) and almost everything else stays in a 'status-quo' condition. Almost everything, that is. We do allow interrupts to occur from the hardware clock. My simulations using the hardware clock tied to the non-maskable interrupt (NMI) line showed the clock ticks to be unnoticeable. If they were noticeable, we have an alternative; we could use the interrupt request (IRQ) line which is maskable. The difference is negligible, and at worst we would only lose several seconds out of every five minutes while sending the ident code.

"If we want to use the hardware clock (4020 and 4024 dividers) for IRQ operation, it probably would be better to open a link (CB2 to GND) and configure the 6820 PIA for interrupts through the IRQB line. In this case, we must do a 'read' in the TIMID routine. See Figure 1. Line 2490 will have to be changed to a "FDB TIMID" instruction and line 2510 changed to "RMB 1". This now vectors us into the time clock routine via the interrupt on IRQB.

"With the hardware clock made of the 4024 and 4020, the closest to a 1 second time tick that could be obtained reasonably was .88 seconds. Thus lines 460, 610 and 710 contained calibrated numbers which provide the desired timings.

"Another approach would be to use presettable counters to give exactly one second or to use another 555 timer, free running, with an adjustment to put it exactly on one second pulses. (My simulation does this.)

"Since we are discussing different approaches, Motorola has just come out with a new CPU (which they call MPU). It is the 6802. It has the 6871A clock (except for the crystal) and the 6810 built in. This means a TV color crystal can probably be tied directly to two pins on the 6802 and eliminate the 6871 and the 6810.

"Furthermore, a 2704 EPROM could be used in place of the 2708 since the program uses only 427 decimal bytes. I do not recommend this, however, since this should only be the start of something big! Later additions to the program can do various neat things, occasionally calling on the already existing routines."

"How about phone patches, weather bulletins, off frequency reports, and so on?"

"Let me make an off-hand comment, George. This program has not been optimized, and there are places where the index register was used to permit 16 bit arithmetic to allow for the slower code speeds in case someone should want to lift the SENCO subroutine for some other code sending application. But for now, this is very convenient for us."□

ACKNOWLEDGEMENT

I would like to thank Brand-Rex, Teltronics Division for the use of their high speed printer which saved much time on this project.

ABOUT THE AUTHOR

Bill Hunsicker, K4DF/W5HKM, age 53, is a professional engineer #3544 Oklahoma. He received his amateur license at age 14, and graduated from Georgia Tech with BEE in 1951. He served in the Navy during World War II, has a private pilot's license, and a radio telephone license first class.

He took up personal computer programming a little over a year ago, and took a 3-day cram course from Motorola on the 6800. He has found that programming in software is just a step forward from what he had been doing in hardware decision making, except that trading hardware in for software opens a vast new field.

PROGRAM LISTING

```
00150                   * DTCT: $2B/20WPM, $38/15WPM, $68/10WPM
00160                          OPT     0
00170                   *
00180           4004    PIAD   EQU     $4004     OUTPUTS
00190           4005    PIAC   EQU     $4005
00200           4006    PIBD   EQU     $4006     INPUTS
00210           4007    PIBC   EQU     $4007
00220           007F    STK    EQU     $7F
00230           002B    DTCT   EQU     $2B       DIT COUNT
00240                   *
00250 0000                     ORG     $0
00260 0000 0001         MIN3   RMB     1
00270 0001 0002         MINTEN RMB     2
00280 0003 0002         IDFIV  RMB     2
00290 0005 0002         XTEMP  RMB     2
00300 0007 0002         TONECT RMB     2
00310 0009 0001         TXFLG  RMB     1
00320 000A 0001         WINFLG RMB     1
00330                   *
00340 8000                     ORG     $8000
00350 8000 01           START  NOP
00360 8001 0F                  SEI               SET INT MASK
00370 8002 CE FF1F             LDX     #$FF1F    ALL OUTPUTS
00380 8005 FF 4004             STX     PIAD      IN A SIDE
00390 8008 CE 001F             LDX     #$1F      ALL INPUTS
00400 800B FF 4006             STX     PIBD      IN B SIDE
00410 800E 8E 007F             LDS     #STK      SET STACK
00420 8011 CE 8190             LDX     #IDENT    IDENTIFY
00430 8014 BD 8145             JSR     SENCO     IDENT CODE
00440 8017 CE 819E             LDX     #RESET    CODE IDENT
00450 801A BD 8145             JSR     SENCO     SEND CODE
```

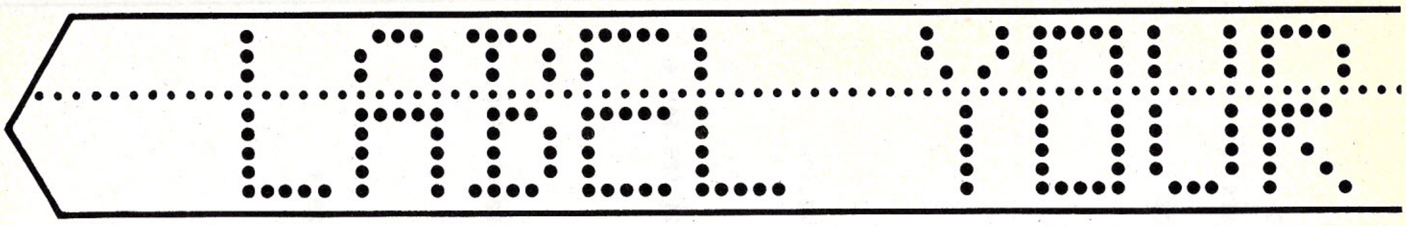
Continued on next page

```
801D CE 0108        LDX    #$108     5 MIN (.88)
8020 DF 03          STX    IDFIV     SET SOFT CLOCK
8022 8E 007F RUN    LDS    #STK      RESET STACK
8025 CE 4004        LDX    #PIAD     POINT AT PIA
8028 F6 02          LDA B  2,X       DUMMY READ
802A A6 00          LDA A  0,X       DUMMY READ
802C 7F 0009        CLR    TXFLG     CLEAR TX FLAG
802F 7F 000A        CLR    WINFLG    WINDBAG FLAG
8032 01             NOP              ODD-PARITY/MASK
8033 0E             CLI              CLEAR INT. MASK
             *
8034 BD 80F5 READIN JSR    TXOFF     TURN TX OFF
8037 F6 4006        LDA B  PIBD      READ INPUTS
803A C4 01          AND B  #1        MASK OUT RX BIT
803C 27 F6          BEQ    READIN    RX OFF, DO AGN
803E CE 0210        LDX    #$210     10 MIN (.88)
8041 DF 01          STX    MINTEN    SET SOFT TIMER
8043 8D 2A          BSR    TXON      TURN TX ON
8045 CE FFFF        LDX    #$FFFF    FOR 1.5 SEC
8048 F6 4006 KCHTIM LDA B  PIBD      READ INPUTS
804B C4 01          AND B  #1        READ RX BIT
804D 27 E5          BEQ    READIN    DUMP TX
804F 09             DEX              COUNT DOWN
8050 26 F6          BNE    KCHTIM    TIMING
             *
8052 86 9D   NOKCH  LDA A  #$9D      3 MIN (.88)
8054 97 00          STA A  MIN3      WINDBAG TIMER
8056 7C 000A        INC    WINFLG    SET WIND FLAG
8059 F6 4006 RDR    LDA B  PIBD      READ INPUTS
805C C4 01          AND B  #1        READ RX BIT
805E 27 5A          BEQ    TAIL      NO, DELAY+BEEP
8060 DE 01          LDX    MINTEN    IS IT =0?
8062 26 03          BNE    *+5       NO, CONTINUE
8064 7E 80F1        JMP    WARN6     YES, SEND WARN
8067 7D 0000        TST    MIN3      IS IT =0?
806A 26 ED          BNE    RDR       NO, CONTINUE
806C 7E 80F4        JMP    WARN3     YES, SEND WARN
             *
806F C6 80   TXON   LDA B  #$80      TX BIT
8071 FA 4004        ORA B  PIAD      SAVE PRIOR
8074 F7 4004        STA B  PIAD      TURN TX ON
8077 7C 0009        INC    TXFLG     SET TX FLAG
807A 39             RTS
             *
             * JUMPED OUT OF LOOP
             *
807B 8E 007F RECON  LDS    #STK      RESET STK
807F 20 D2          BRA    NOKCH     NO WINDY
8080 8E 007F TLGATE LDS    #STK
8083 20 D4          BRA    RDR       TAILGATE RETURN
             *
             * NMI - 1 SEC PULSES
             *
8085 7D 000A TIMID  TST    WINFLG    WIND TIMER ON?
8088 27 08          BEQ    N1        NO, GET OUT
808A 7A 0000        DEC    MIN3      YES, DEC TIMER
808D 26 03          BNE    N1        TIMER=0?
808F 7F 000A        CLR    WINFLG    YES, CLR FLG
8092 7D 0009 N1     TST    TXFLG     TX TIMER ON?
```

```
810C 39             RTS
             *
810D CE 002B DIT    LDX    #DTCT     DIT COUNT
8110 20 03          BRA    *+5       STORE IT
8112 CE 0081 DAH    LDX    #3*DTCT   DAH COUNT
8115 DF 07          STX    TONECT    PUT IN COUNTER
8117 B6 4004 TONOUT LDA A  PIAD      GET STATUS
811A 8A 40          ORA A  #$40      TONE BIT ON
811C B7 4004        STA A  PIAD      PUT IT OUT
811F 8D F6          BSR    UNITIM    DELAY 500 MICRO SEC.
8121 84 BF          AND A  #$BF      TONE BIT OFF
8123 B7 4004        STA A  PIAD      PUT IT OUT
8126 8D DF          BSR    UNITIM    DELAY 500 MICROSEC
8128 DE 07          LDX    TONECT    GET COUNT
812A 09             DEX              SUBTRACT 1
812B DF 07          STX    TONECT    PUT IT BACK
812D 26 F8          BNE    TONOUT    SEND ANOTHER
812F CE 0056 UNISPC LDX    #2*DTCT   UNIT SPACE
8132 8D D3   UNSP   BSR    UNITIM    500 MICRO
8134 09             DEX              SUBTRACT 1
8135 26 FB          BNE    UNSP      EQUAL 0?, NO DO AGAIN
8137 39             RTS              YES, RETURN
             *
8138 8D F5   UNISP2 BSR    UNISPC    1 UNIT SPACE
813A 8D F3          BSR    UNISPC    1 UNIT SPACE
813C 39      END    RTS              RETURN TO CALLER
             *
813D 8D F9   WRDSPC BSR    UNISP2    2 SPC UNITS
813F 8D F7          BSR    UNISP2    "  "   "
8141 8D F5          BSR    UNISP2    "  "   "
8143 DE 05          LDX    XTEMP
8145 BD 806F SENCO  JSR    TXON
8148 A6 00          LDA A  0,X       GET A CHAR
814A 08             INX              MOVE POINTER
814B DF 05          STX    XTEMP     SAVE POINTER
814D 81 04          CMP A  #4        IS IT EOT?
814F 27 EB          BEQ    END       YES, GO TO END
8151 81 21          CMP A  #$21      NO. IS IT A SPACE?
8153 27 E8          BEQ    WRDSPC    YES, DELAY WRD
8155 48      SHIFT  ASL A            NO, SHIFT OVER
8156 36             PSH A            SAVE A ON STACK
8157 24 0D          BCC    DITOUT    CARRY CLEAR?
8159 8D B7          BSR    DAH       NO, SEND DAH
815B 32      ENCHA  PUL A            RESTORE A
815C 81 80          CMP A  #$80      END OF CHAR?
815F 26 F5          BNE    SHIFT     NO, SHIFT OVER
8160 8D D6          BSR    UNISP2    2 SPACE UNITS
8162 DE 05          LDX    XTEMP     RESTORE POINTER
8164 20 DF          BRA    SENCO     CONTINUE
             *
8166 8D A5   DITOUT BSR    DIT       SEND DIT
8168 20 F1          BRA    ENCHA     CHECK END CHAR
             *
816A 8D 09   DEL5   BSR    DELONE    DELAY 1 SEC
816C 8D 07          BSR    DELONE
816E 8D 05   DEL3   BSR    DELONE
8170 8D 03          BSR    DELONE
8172 8D 01          BSR    DELONE
8174 39             RTS
             *
```

```
8095 27 0A           BEQ    N2       NO, GET OUT
8097 DE 01           LDX    MINTEN   YES, GET TIME
8099 09              DEX             DEC IT
809A DF 01           STX    MINTEN   PUT IT BACK
809C 26 03           BNE    N2       IS IT=0?
809E 7F 0009         CLR    TXFLG    YES, CLR FLG
80A1 DE 03    N2     LDX    IDFIV    I.D. COUNT
80A3 09              DEX
80A4 DF 03           STX    IDFIV
80A6 26 0B           BNE    OUT1     IS IT =0?
80A8 CE 8190         LDX    #IDENT   IDENTIFY CODE
80AB BD 8145         JSR    SENCO    YES, SEND I. D.
80AE CE 01B0         LDX    #$1B0    5 MIN. WORTH
80B1 DF 03           STX    IDFIV    RESET CLOCK
80B3 B6 4004  OUT1   LDA A  PIAD     CLEAR INT
80B6 F6 4006         LDA A  PIBD     CLEAR INT
80B9 3B              RTI
              *
80BA CE B290  TAIL   LDX    #$B290   1 SEC
80BD 8D 10           BSR    TLDLA    GO DELAY (1)
80BF BD 8184         JSR    BEEP1    PAUSE SIGNAL
80C2 CE FFFF         LDX    #$FFFF
80C5 8D 13           BSR    TLDLAY   GO DELAY (2)
80C7 CE 5560         LDX    #$5560
80CA 8D 0E           BSR    TLDLAY
80CC 7E 8022         JMP    RUN      START OVER
              *
80CF F6 4006  TLDLA  LDA B  PIBD     READ INPUTS
80D2 C4 01           AND B  #1       READ RX BIT
80D4 26 AA           BNE    TLGATE   TAILGATED
80D6 09              DEX             DELAY 1 SEC
80D7 26 F6           BNE    TLDLA    CONTINUE
80D9 39              RTS
              *
80DA F6 4006  TLDLAY LDA B  PIBD     INPUTS
80DD C4 01           AND B  #1       RECEIVER BIT
80DF 26 9A           BNE    RECON    CONTINUE
80E1 09              DEX             DECREMENT
80E2 26 F6           BNE    TLDLAY   MORE DELAY
80E4 39              RTS
              *
80E5 F6 4004  TXOFF  LDA B  PIAD     READ CONDX
80E8 C4 7F           AND B  #$7F     MASK
80EA F7 4004         STA B  PIAD     TURN IT OFF
80ED 7F 0009         CLR    TXFLG
80F0 39              RTS
              *
80F1 BD 817E  WARN6  JSR    BEEP3    3 BEEPS
80F4 BD 817E  WARN3  JSR    BEEP3    3 BEEPS
80F7 8D 75           BSR    DEL3     DELAY 3 SEC
80F9 8D EA    HOLDOF BSR    TXOFF
80FB F6 4006         LDA B  PIBD
80FE C4 01           AND B  #1       READ RX BIT
8100 26 F7           BNE    HOLDOF   GET RX BIT
8102 8D 66           BSR    DEL5     DELAY 5 SEC
8104 7E 8022         JMP    RUN      RX OFF, GO START
              *
8107 C6 4A    UNITIM LDA B  #$4A     (500 MICROSEC)
8109 5A       UNITI  DEC B           SUBTRACT 1
810A 26 FD           BNE    UNITI    NOT=0, REPEAT

8175 CE 07A6  DELONE LDX    #$7A6    1958 CTS
8178 8D 8D    DELX   BSR    UNITIM   500 MICRO
817A 09              DEX             SUBTRACT 1
817B 26 FB           BNE    DELX     DO IT AGAIN, SAM!
817D 39              RTS
              *
817E CE 8189  BEEP3  LDX    #BEEPR3  POINT CODE
8181 8D C2           BSR    SENCO    SEND IT
8183 39              RTS
              *
8184 CE 818D  BEEP1  LDX    #BEEPR1  POINT
8187 20 F8           BRA    *-6      SEND IT
              *
              *   DATA
              *
8189 21       BEEPR3 FCB    $21,$40,$21,$40
818A 40
818B 21
818C 40
818D 21       BEEPR1 FCB    $21,$40,4
818E 40
818F 04
8190 70       IDENT  FCB    $70,$50,$0C,$60,$70,$78
8191 50
8192 0C
8193 60
8194 70
8195 78
8196 21              FCB    $21,$48,$B0,$48,$21,$28,$48,4
8197 48
8198 B0
8199 48
819A 21
819B 28
819C 48
819D 04
819E 21       RESET  FCB    $21,$68,$50,$D0,$E0,$21,$88,$B8
819F 68
81A0 50
81A1 D0
81A2 E0
81A3 21
81A4 88
81A5 B8
81A6 21              FCB    $21,$B0,$0C,$90,$28,4
81A7 B0
81A8 0C
81A9 90
81AA 28
81AB 04
              *
              *
83F8                 ORG    $83F8
83F8 0002            RMB    2
83FA 0002            RMB    2
83FC 8085            FDB    TIMID
83FE 8000            FDB    START
              *
                     END
```



TLABEL: An 8080 Program to Punch Human-Readable Labels on Paper Tape

By Alan R. Miller, Contributing Editor

Have you ever discovered unlabeled tapes lying about and wondered what they were? Did you attempt to print them, only to find that they were punched in a binary or hexadecimal format? Would you like to have the file name and address in a form that you can read at the beginning of each tape? TLABEL can do that. TLABEL is an 8080 assembly-language program that can be used to punch human-readable messages on paper tape. It uses the set of 63 ASCII characters:

ABCDEFGHIJKLMNOPQRSTUVWXYZ

0123456789

!"#$%&'()* + ,-./ :;<=>?@ [\]^

and a blank. These represent the ASCII values 20 to 5E HEX (040 to 135 octal).

TLABEL can be used two ways: either by itself or as a subroutine that can be called by a monitor, or by BASIC. To use TLABEL in the stand-alone mode, jump to the first instruction "START" at address 5E00 HEX. To use it as a subroutine, call "SUBR" at address 5E09 HEX. In the latter case, your calling program must provide four levels (8 bytes) of stack. In either case, a 5-inch leader is punched out when TLABEL is started.

Type the desired message, including any necessary blanks, then signal the end of the message by typing a Control-Z (all other control characters are ignored). Another five inches of blank tape will now appear and the program counter will jump to the address defined "MONIT" in the source program (zero in this case) if TLABEL is being used in the stand-alone version. Alternately, control will return to your calling program if TLABEL was called as a subroutine.

TLABEL can also be used to punch labels on BASIC source tapes. For use with MITS BASIC, answer the question "MEMORY SIZE?" during initialization with a value that will keep BASIC from plowing through TLABEL (24063 for TLABEL at 5E00 HEX). For MITS extended BASIC versions 4.0 and 4.1, put the following two lines at the end of your regular source program:

```
5000 DEFUSR = &H 5E09: REM POINT USR TO TLABEL
5010 X = USR(9): LIST
```

Be sure that the statement prior to 5000 is an unconditional branch, such as a RETURN or GOTO, or is a STOP or END. Then give the direct command:

```
RUN 5000
```

The USR function will call TLABEL, allowing you to punch out the message on the tape leader. Type a Control-Z when finished and control will return to BASIC at the next expression after the USR command. Since this is LIST, the source program will then automatically be punched out.

Other versions of MITS BASIC should be changed to:

```
5000 US = 73: POKE US, 9: POKE US + 1, 94
```

This command will patch USRLOC with the address of TLABEL's subroutine entry for MITS 8K, versions 3.2 and higher. For extended BASIC version 3.2, USRLOC is at 65 decimal. Therefore, the above statement should read US = 65.

In the 4K versions USRLOC is at 111 octal (49 HEX). However, a manual patch must be made since the POKE function is not available. Now only one line is needed:

```
5000 X = USR(9): LIST
```

The direct command is still:

```
RUN 5000
```

TLABEL requires 421 bytes including 8 bytes of stack. The HEX checksummed listing is assembled for the address range 5E00 to 5FA5. Keyboard input is at address 10/11 HEX (20/21 octal); in stand-alone mode, the separate punch is addressed to 12/13 HEX (22/23 octal). The keyboard-input address and the punch address can be the same (e.g. if a teletypewriter is used as the only peripheral) since the keyboard input is not echoed. The locations in Figure 1 may need to be changed for your system. □

Figure 1.

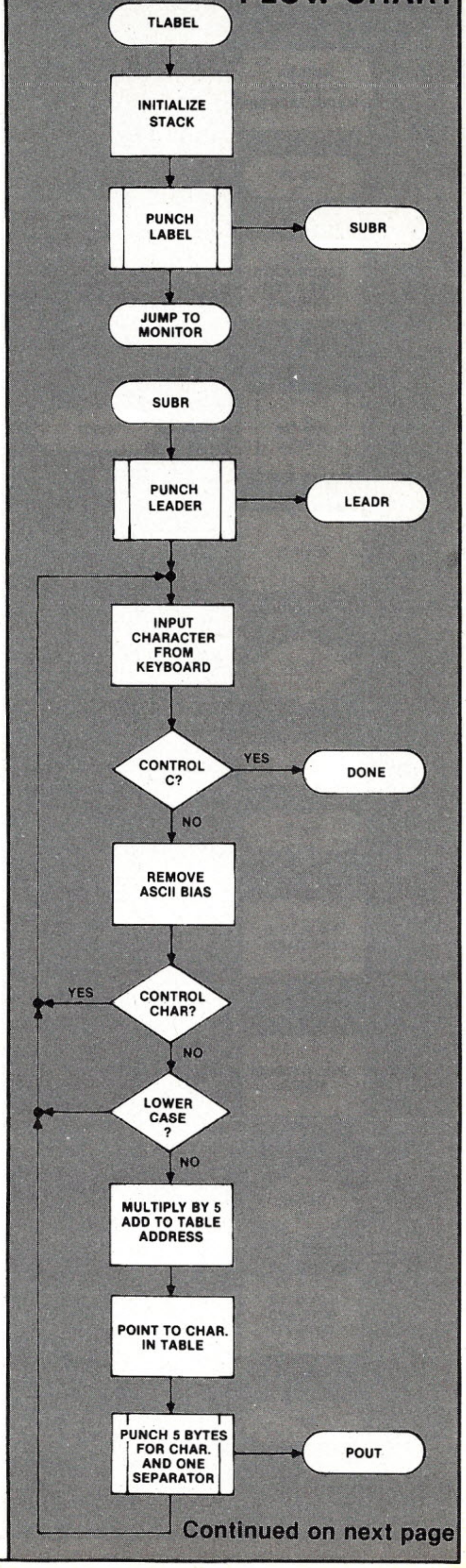
	Source Program Variable	Address (HEX)	Data (HEX)
Your monitor	MONIT	5E07,8	0000
Keyboard status addr	TYSTAT	5E0D	10
Keyboard data addr	TYDATA	5E14	11
Input-ready mask	INMSK	5E0F	01
Jump zero		5E10	CA
Punch status addr	PSTAT	5E57	12
Punch data addr	PDATA	5E5F	13
Output-ready mask	PMASK	5E59	02
Jump zero		5E5A	CA

TAPES

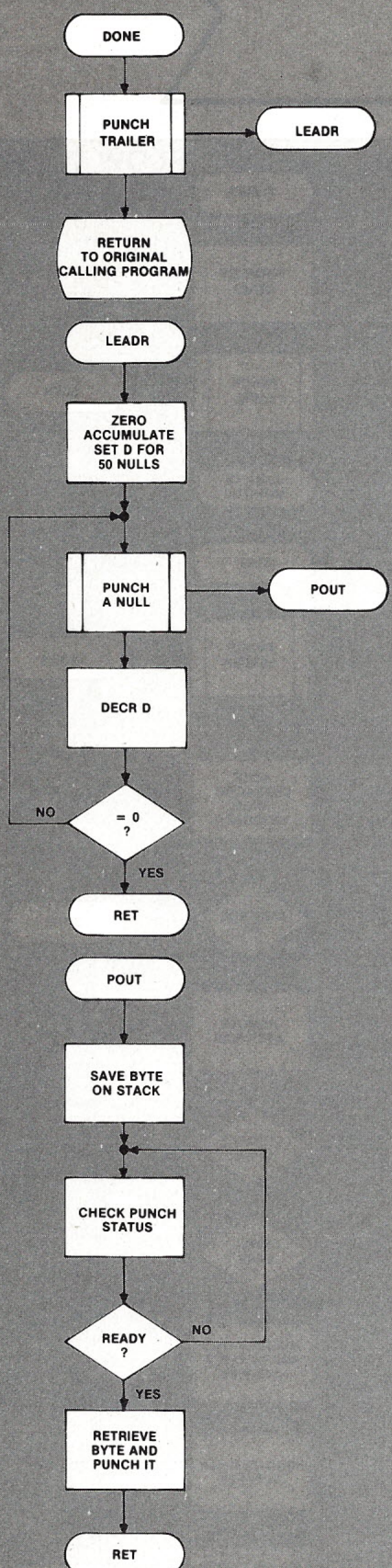
PROGRAM1

```
;TLABEL WILL PUNCH HUMAN-READABLE LABELS ØN PAPER TAPE
;THAT LØØK SØMETHING LIKE THIS:
;
;  ***  ****   ***  ****  ***** *****  ***  *   *  ***
; *   * *   * *   * *   * *     *     *   * *   *   *
; *   * *   * *     *   * *     *     *     *   *   *
; ***** ****  *     *   * ***** ****  *     *****   *
; *   * *   * *     *   * *     *     * *** *   *   *
; *   * *   * *     *   * *     *     *   * *   *   *
; *   * *   * *   * *   * *     *     *   * *   *   *
; *   * ****   ***  ****  ***** *      ***  *   *  ***
;
;THE CØMPLETE SET ØF 63 CHARACTERS IS:
; !"#$%&'()*+,-./0123456789:;<=>?@
; ABCDEFGHIJKLMNØPQRSTUVWXYZ[\]↑
; AND A BLANK
;
;TØ USE TLABEL AS A STAND-ALØNE PRØGRAM, JUMP TØ START.
;A LEADER WILL BE PUNCHED ØUT, THEN ANY ØF THE ABØVE
;CHARACTERS CAN BE PUNCHED ØN THE TAPE BY PRESSING THE
;CØRRESPØNDING KEYS.  AT THE END ØF THE MESSAGE, TYPE
;A CØNTRØL-Z.  A TRAILER WILL BE PUNCHED AND THE
;PRØGRAM CØUNTER WILL JUMP TØ THE ADDRESS DEFINED
;BY THE LABEL "MØNIT".  THIS WØULD NØRMALLY BE
;YØUR MØNITØR.
;
;FØR USE AS A SUBRØUTINE, CALL "SUBR", THE TENTH
;(DECIMAL) ADDRESS IN THE PRØGRAM.  TYPING A
;CØNTRØL-Z WILL CAUSE A RETURN TØ YØUR CALLING
;PRØGRAM.  FØUR LEVELS (8 BYTES) ØF STACK
;ARE NEEDED IN YØUR PRØGRAM.
;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;
;EQUATES
;
MØNIT    EQU     0       ;JUMP TØ YØUR MØNITØR
                         ;ØN CØNTRØL-Z
TYSTAT   EQU     10H     ;KEYBØARD STATUS ADDRESS
TYDATA   EQU     11H     ;KEYBØARD DATA ADDRESS
INMSK    EQU     1       ;KEYBØARD INPUT-READY MASK
PSTAT    EQU     12H     ;PUNCH STATUS
PDATA    EQU     13H     ;PUNCH DATA
PMASK    EQU     2       ;PUNCH-READY MASK
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;
;ENTER AT THIS PØINT WHEN USED AS MAIN PRØGRAM
5E00 31A45F      START:  LXI     SP,STACK  ;STACK IS AT END ØF PRØGRAM
5E03 CD095E              CALL    SUBR
5E06 C30000              JMP     MØNIT     ;JUMP TØ YØUR MØNITØR WHEN DØNE
                 ;
                 ;CALL AT THIS PØINT FØR USE AS A SUBRØUTINE
                 ;
5E09 CD4A5E      SUBR:   CALL    LEADR     ;PUNCH A LEADER
                 ;
                 ;INPUT A CHARACTER FRØM THE KEYBØARD
                 ;
5E0C DB10        READ:   IN      TYSTAT    ;CHECK STATUS
5E0E E601                ANI     INMSK     ;MASK UNWANTED BITS
5E10 CA0C5E              JZ      READ      ;LØØP UNTIL READY
5E13 DB11                IN      TYDATA    ;READ CHARACTER
5E15 E67F                ANI     7FH       ;STRIP PARITY
5E17 FE1A                CPI     1AH       ;QUIT ØN CØNTRØL-Z
5E19 CA465E              JZ      DØNE
5E1C DE20                SBI     20H       ;REMØVE ASCII BIAS
5E1E DA0C5E              JC      READ      ;SKIP CØNTRØL CHARACTER
5E21 FE3F                CPI     63
5E23 D20C5E              JNC     READ      ;SKIP LØWER CASE
5E26 6F                  MØV     L,A       ;SAVE CHARACTER IN L
5E27 5F                  MØV     E,A       ; AND E
5E28 2600                MVI     H,0       ;ZERØ H
5E2A 1600                MVI     D,0       ; AND D
                 ;
                 ;FIND THE TABLE ØFFSET BY MULTIPLYING THE
                 ;CHARACTER VALUE BY FIVE (5 PUNCHES PER
                 ;CHARACTER) AND ADDING IT TØ THE TABLE
                 ;ADDRESS
                 ;
5E2C 29                  DAD     H         ;DØUBLE THE CHAR. VALUE
5E2D 29                  DAD     H         ;THEN QUADRUPLE IT
5E2E 19                  DAD     D         ;NØW TIMES FIVE
5E2F EB                  XCHG              ;SAVE IT IN D/E
5E30 21615E              LXI     H,TABLE   ;PØINT TØ TABLE
5E33 19                  DAD     D         ;ADD ØFFSET
5E34 1E05                MVI     E,5       ;READY FØR 5 PUNCHES PER CHAR.
```

FLOW CHART



Continued on next page




```
5E36 7E          NEXTC:  MØV    A,M       ;FETCH PUNCH CØDE
5E37 CD555E              CALL   PØUT      ;PUNCH IT
5E3A 23                  INX    H         ;INCREMENT PØINTER TØ NEXT
5E3B 1D                  DCR    E         ;DECREMENT CØUNT
5E3C C2365E              JNZ    NEXTC
5E3F AF                  XRA    A         ;PUNCH A BLANK
5E40 CD555E              CALL   PØUT      ; BETWEEN EACH CHARACTER
5E43 C30C5E              JMP    READ      ;NEXT CHARACTER
                 ;
                 ;FINISHED, PUNCH TRAILER AND RETURN TØ CALLING
                 ;PRØGRAM ØR JUMP TØ YØUR MØNITØR
                 ;
5E46 CD4A5E      DØNE:   CALL   LEADR     ;PUNCH  TRAILER
5E49 C9                  RET
                 ;
                 ;SUBRØUTINE TØ PUNCH A LEADER ØN TAPE
                 ;
5E4A AF          LEADR:  XRA    A         ;SET FØR NULL
5E4B 1632                MVI    D,50      ;NUMBER ØF NULLS
5E4D CD555E      NLDR:   CALL   PØUT      ;PUNCH A BLANK
5E50 15                  DCR    D
5E51 C24D5E              JNZ    NLDR
5E54 C9                  RET
                 ;
                 ;SUBRØUTINE TØ ØUTPUT DATA TØ PUNCH
5E55 F5          PØUT:   PUSH   PSW
5E56 DB12        PØUTW:  IN     PSTAT     ;CHECK STATUS
5E58 E602                ANI    PMASK     ;MASK UNWANTED BITS
5E5A CA565E              JZ     PØUTW     ;LØØP UNTIL READY
5E5D F1                  PØP    PSW
5E5E D313                ØUT    PDATA     ;PUNCH BYTE
5E60 C9                  RET
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ;
                 ;TABLE ØF PUNCH SYMBØLS FØR THE CHARACTER SET
                 ;
5E61 00          TABLE:  DB     0,0,0,0,0, 0,0,207,207,0 ; BLANK,!
5E6B 00                  DB     0,7,0,7,0, 40,254,40,254,40 ; ",#
5E75 46                  DB     70,137,255,137,114 ; $
5E7A 46                  DB     70,38,16,200,196 ; %
5E7F 6C                  DB     108,146,172,64,160, 0,4,3,3,0 ; & '
5E89 00                  DB     0,60,66,129,0, 0,129,66,60,0 ; ( )
5E93 88                  DB     136,80,248,80,136, 8,8,126,8,8 ; *,+
5E9D 00                  DB     0,128,112,48,0, 8,8,8,8,8 ; , -
5EA7 00                  DB     0,192,192,0,0, 64,32,16,8,4 ; . /
5EB1 7E                  DB     126,161,137,133,126 ; 0
5EB6 84                  DB     132,130,255,128,128 ; 1
5EBB C2                  DB     194,161,145,137,134 ; 2
5EC0 42                  DB     66,137,137,137,118 ; 3
5EC5 0C                  DB     12,10,137,255,136 ; 4
5ECA 67                  DB     103,137,137,137,113 ; 5
5ECF 7E                  DB     126,137,137,137,114, 1,1,249,5,3 ; 6,7
5ED9 76                  DB     118,137,137,137,118 ; 8
5EDE 46                  DB     70,137,137,137,126 ; 9
5EE3 00                  DB     0,216,216,0,0, 0,128,118,54,0 ; : ;
5EED 10                  DB     16,40,68,130,0, 40,40,40,40,40 ; < =
5EF7 82                  DB     130,68,40,16,0, 6,1,185,9,6 ; > ?
5F01 7E                  DB     126,129,157,145,14 ; @
5F06 FE                  DB     254,9,9,9,254 ; A
5E0B 81                  DB     129,255,137,137,118 ; B
5F10 7E                  DB     126,129,129,129,66 ; C
5F15 81                  DB     129,255,129,129,126 ; D
5F1A FF                  DB     255,137,137,137,137, 255,9,9,9,1 ; E,F
5F24 7E                  DB     126,129,145,145,114, 255 8,8,8,255 ;G,H
5F2E 00                  DB     0,129,255,129,0, 96,128,129,127,1 ; I,J
5F38 FF                  DB     255,8,20,34,193 ; K
5F3D FF                  DB     255,128,128,128,128 ; L
5F42 FF                  DB     255,2,12,2,255, 255,2,60,64,255 ; M,N
5F4C FF                  DB     255,129,129,129,255, 255,9,9,9,6 ; Ø,P
5F56 7E                  DB     126,129,161,65,190 ; P,Q
5F5B FF                  DB     255,25,41,73,134 ; R
5F60 46                  DB     70,137,137,137,114 ; S
5F65 01                  DB     1,1,255,1,1, 127,128,128,128,127 ; T,U
5F6F 0F                  DB     15,48,192,48,15 ; V
5F74 7F                  DB     127,128,112,128,127 ; W
5F79 C3                  DB     195,36,24,36,195, 3,4,248,4,3 ; X,Y
5F83 C1                  DB     193,161,145,137,135 ; Z
5F88 00                  DB     0,255,129,129,129, 4,8,16,32,64 ;[ \
5F92 81                  DB     129,129,129,255,0, 12,2,1,2,12 ;] ↑
                 ;
5F9C                     DS     8         ;STACK SPACE
5FA4             STACK:  DS     1
                         END
```

PROGRAM 2

```
:105E000031A45FCD095EC30000CD4A5EDB10E60120
:105E1000CA0C5EDB11E67FFE1ACA465EDE20DA0C93
:105E20005EFE3FD20C5E6F5F26001600292919EB3B
:105E300021615E191E057ECD555E231DC2365EAF03
:105E4000CD555EC30C5ECD4A5EC9AF1632CD555EF0
:105E50001 5C24D5EC9F5DB12E602CA565EF1D313D8
:105E6000C900000000000000CFCF00007000700BD
:105E700028FE28FE284689FF8972462610C8C46C71
:105E800092AC40A0000403030000 3C428100008 16A
:105E9000423C008850F8508808087E080800807 04E
:105EA00030000808080800C0C000004020 1008A2
:105EB00047EA189857E8482FF8080C2A19189862B
:105EC0004289898 9760C0A89FF8867898989717E68
:105ED00089898972010 1F9050376898989764689 5C
:105EE00089897E00D8D800000080763600102844CA
:105EF00082002828282828824428100006 01B90991
:105F000067E819D910EFE090909FE81FF89897631
:105F10007E8181814281FF81817EFF89898989FF1C
:105F20000909090 17E8191917 2FF080808FF00812B
:105F3000FF81006080817F01FF081422C1FF808003
:105F40008080FF020C02FFFF023C40FFFF8181 8145
:105F5000FFFF09090906 7E81A141BEFF1929498673
:105F600046898989720101FF01017F808080 7F0F4E
:105F700030C0300F7F8070807FC3241824C3030497
:105F8000F80403C1A191898700FF818181040810 71
:105F90002040818181FF000C0201020C0000000002
:045FA00000000000FD
:005E0001A1
```

An Index to INTERFACE AGE 1978

Compiled by Jim Schreier

The amount of information recorded in Volume 3 of INTERFACE AGE is vast. The purpose of this index is to recover as much key information as possible within a limited space, so it is subject oriented. Eleven major subjects are grouped together, however, the alphabetical flow of remaining minor subjects continues. Articles are capitalized, referenced subjects are in caps and lower case. Book reviews are found under "Products." Effort was made to distinguish between BASIC and assembled listings under "Applications Software." If a specific BASIC listing or chip description was referenced, that reference is maintained.

An index not used is a waste. We hope that this index to 1978 INTERFACE AGE proves to be helpful throughout the coming years, especially to those who have yet to discover the joy of microcomputing.☐

HARDWARE REVIEWS

INDEX

MEDICINE

PRODUCTS

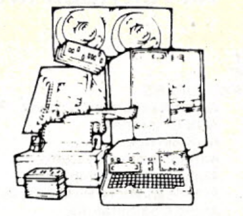
SOFTWARE REVIEWS

*Back issues are no longer available.

†Not available for reprints.

MICRO-MARKET

FIFO FLEA MARKET



FOR SALE OR TRADE: 16K dynamic memory chips with documentation, $10 each or make an offer. H. Gerber, 1031 W. 43rd, Houston, TX 77018.

FOR SALE: TRS-80 software, business oriented — Level 2 only. Includes accounts receivable and payroll. Write for details. From $20 up. Jack Hatfield, 2895 Bedford Ave., Placerville, CA 95667.

FOR SALE: Morrow/Thinker Toys front panel CPU board assembled and tested with all documentation. Certified funds for $250 includes UPS shipping. C. W. Prather, 126 Dogwood Lane, Kinston, NC 28501, (919) 522-2327.

FOR SALE: TRS-80 Level I tapes and lists. Star Trek War (runs on 12K) list $7, tape $10; Biorhythm (4K) list $4, tape $7; Lunar Lander (4K) list $4, tape $7. All three for only $20. J.R. Menzies, 1011 Neal Dr., Alexandria, VA 22308.

FOR SALE: TRS-80, 16K, Level with monitor and cassette deck. Used very little, perfect conditoin, $875. John Oventile, 3839 Lake Ave. S., Duluth, MN 55802.

FOR SALE: TRS-80 16K Level II. Like new, $800 including Editor/Assembler. NYC area preferred. Alan Goott (212) 759-8400 days, 752-7634 evenings.

FOR SALE: TRS-80 games in 4K Level I. Lunar Lander (graphic), Graphic Concentration, Graphic Hangman, Graphic Biorhythm, Star Trek, Juke Box (with six songs), Chess in Graphics, and many more. For complete catalog send SASE to Mike Sobetzko, 6631 Nagle Ave., Van Nuys, CA 91401.

FOR SALE: Multiprogramming Operating System for timesharing. Designed for Motorola 6800, operates in conjunction with an Interrupt Timer Device (SWTPC MP-T, etc.) & maintains a time of day clock. Send $10 for complete documentation & source code. Ed Joyce, 4603 Lyceum, San Antonio, TX 78229.

FOR SALE: Netronics Elf II. Up and running. Includes Giant Board, 4K RAM, expansion power supply, ASCII keyboard, video monitor, Tiny BASIC cassette and manual, expansion connectors, Tom Pittman's programming course, & complete instructions. Sockets used exclusively. Extras included. $399. Mike Otis, 1710 16th Ave. SE, Aberdeen, SD 57401.

WANTED: Contact with any computerist or other persons interested in trend analysis in commodities and stocks. Wish to exchange ideas, methodology, programs, etc. Contact Ed Tenberg, Box 407, Little Neck, NY 11363.

FOR SALE: PILOT for the TRS-80 in Level II BASIC. Runs in 4K machine with enough room for the average 50 line program, $25. TRS-80 business program, runs on 16K disk BASIC with one disk. Mass indexing system allows up to 2,000 items to be stored on disk and retrieved instantly with associated data, $50. Modems for any computer with a cassette recorder hookup, made especially for TRS-80, can be run on 4K Level I system, $50. Write: Sandy Sigal, 6851 Mammoth Ave., Van Nuys, CA 91405.

FOR SALE: Digital Group Phi-Deck cassette system. 4 computer-controlled tape drives in cabinet, controller, cable, documentation and software. 2M bytes on line (C-60 cassettes) with any system. $675 or best offer. Write John Ciaccia, 5707 Valley Pt., San Antonio, TX 78233 or call (512) 654-0338 evenings.

FOR SALE: JOLT CPU fully socketed and assembled, unused JOLT prototype board, full documentation and MOS 6502 hardware and programming manuals, $140 postpaid. Jack Ball, Route 2, Durham, MO 63438, (314) 439-5789.

FOR SALE: TRS-80 Level II keyboard debounce patch. Eliminate bounce problem in some Level II units by loading this short program on power up. Send $5 for 4K and 16K versions on cassette. Instructions included. Also included is a RAM/ROM test program. Chris Petersen, 2227 Amberwood Ln., San Jose, CA 95132.

FOR SALE: TRS-80 quality business software on diskette or cassette. Lowest cost. Write to: Poi Pow, 96 Dothan St., Arlington, MA 02174.

FOR SALE: Hard copy printout for your TRS-80 programs. For copyrights, documentation, debugging. Level I or II cassettes. Quality listings by tractor-feed Centronics 700 printer on 8½x11 fanfold paper. $2 up to 4K, $4 up to 16K, $6 up to 32K, $8 up to 48K. All orders shipped same day by first class mail. Lydia Urbassik, 13519 Carter Rd., Painesville Twp., OH 44077.

FOR SALE: SWTPC CT-1024 with all options, completely function in plexiglass case, full documentation & extra keyboard mount, $225 or best offer. MP-A Processor board missing MC6800, 6810, MC1411, 8097 and 8098. Assembled with Mikbug and sockets in excellent condition, $60. Micro-Term ACT-IV-B, brand new, barely used, $790. Sony C-102 and 103a cassette recorders, $35 and $40 respectively. Call or write Kevin Wells, 712 N. Palm Dr., Beverly Hills, CA 90210, (213) 271-1606.

ADVERTISER INDEX

*Manufacturer requests factory-direct inquiry.

FOR SALE: Two Wangco Model 82 mini-floppy drives, 40 tracks, write on both sides of disk by flipping it over, can use w/double density controller, pin compatible w/SA400; 2 North Star cabinets; 4' cable for 2 drives; 20 Verbatim soft sectored mini-diskettes; $550. Greg Stuk, 2170-11 Cram Pl., Ann Arbor, MI 48105, (313) 996-0497 or 764-6334 after 6 pm.

FOR SALE: Altair 8800B system with 16K memory, 2 serial ports, 1 parallel port, 8" iCOM dual drive with S-100 interface. ADM3A CRT and FDOS II, CP/M. Call or write Gerald Jurisch, 30 Fairview, Corte Madera, CA 94925, (415) 924-3151.

FOR SALE: Business program for TRS-80 16K Disk BASIC with 1 or 2 disks. Mass indexing allows storing and retrieving items for review, alphabetizing, editing. At least 2,000 items on one disk. Alphabetizes automatically and fully self documenting. $50. Sandy Sigal, 6851 Mammoth Ave., Van Nuys, CA 91405.

FOR SALE: APPLE II Software. Cassette & documentation. Disk compatible catalog prog. , can fetch prog. names from D$CATALOG, $10; Auto SAve/Restore disk to backup tape, $5; graphic Blackjack, paddle-input, auto-play mode, $10. Any 2/$15. All 3/$18. G.W. Lee, 18803 S. Christina Ave., Cerritos, CA 90701.

FOR SALE: High quality word processing tape cassettes. 14 Wang, equivalent to about 45-min. tape, no plastic leader. 10 Redactron, equivalent to 1 hr. tape, metal leader. All either unused or near new. Twelve Wang in folder, $50. Rest $4 each. Clint Chamberlain, P.O. Box 120, Hayes, VA 23072, (804) 642-6034.

FOR SALE: TRS-80 System w/Level II BASIC and 16K RAM in complete and clean condition. $795 shipped UPS/COD collect. Includes Personal & Business software pkgs. at no charge. Original cartons w/manuals. William Buyers, Newcastle, ME 04553, (207) 563-3806.

FOR SALE: SWTPC Multi-user board & 4K BASIC. A & T, fully socketed, never used. $179. Steve Brainerd, 510 E. Washington, Chagrin Falls, OH 44022.

FOR SALE: One Solid State Music Video Board (VB1). Assembled and working. 32/64 character line, graphics, documentation. $150. D. DeMers, 14215 Hamlin St., Van Nuys, CA 91401.

TRS-80/POLY/PET Software: Bomber, Biorhythm, Lander. Use graphics, fit 4K, on tape $9.95. Request a free catalog. (State computer type) Send to: Jester Center, W58, Austin, TX 78784.

FOR SALE: Proc. Tech. GPM $100, 3P + S $120, CUTS $77 w/manuals. Write/call Ward Davis, P.O. Box 628, Annapolis, MD 21401, (301) 263-4832.

FOR SALE: Modems for TRS-80. Will work with any configuration. $50.00 for two months, then $75. Shipment in two weeks ARO. 15% off for two. Send check or M.O. to Sandy Sigal, 6851 Mammoth Ave., Van Nuys, CA 91405.

WANTED: MP-A2 card, MP-8M, M 16 memory, SWTBUG, EPROM programmer & memory, MP-N, MP-L, analog input, printer, productive C.O.S. system for SWTP 6800 system. New or used, kit or assembled, with documen. & spare parts. Contact Dr. Endre Simonyi, 19, Trencsenyi utca Budapest XII, Hungary.

FOR SALE: ASR-33 TTY with paper-tape reader/punch, modem, touch-tone pad and stand, $650. Many back issues of INTERFACE AGE, Byte, Kilobaud, Personal Computing, and others. Send SASE for complete list of magazines, books, and some special hardware items. Lenny Heath, Box 12545, Raleigh, NC 27605, (919) 876-4168.

FOR SALE: RO-33 teletype w/pedestal, 20MA current loop I/O, like new, $475. Heath H9 RS-232 I/O, assembled and working, $485 plus shipping. Also will swap programs in Altair BASIC. Contact Charles Zalenski, P.O. Box 92, Johnson City, NY 13790, (607) 797-5777 days.

FOR SALE: Complete KIM-1 System, basic board, 3K RAM, 1K EPROM, PIA I/O, Video I/O, Hefty power supply, chassis, motherboard, plus in 44-connector boards, ASCII keyboard, cables. Extra 6502, PIAs available. $225 or best offer. Bill Carlquist, 6253 Hollywood Blvd., Suite 202, Hollywood, CA 90028, (213) 461-4643.

FOR SALE: 3 each WW Kluge boards for PDP/LSI-11 or Heath H11. Over 100 sockets quad boards, $70 each. Also small WW card with 21 each 16-pin and 14 each 14-pin WW sockets, $10 with mating connector. 32 column dot matrix printer, parallel ASCII, $85. Write for details. S. Gold, 1582 Glen Lake Rd., Hoffman Estates, IL 60195.

FOR SALE: Apple software — cassette and documentation. Disk-compatible catalog program (e.g. author-title index or disk prog. index), can fetch prog. names from D$CATALOG, $10; Auto Save/Restore disk to backup tape, $5; Graphic Blackjack, paddle-input, auto-play mode, $10. Any 2/$15. All 3/$18. George Lee, 18803 S. Christina Ave., Cerritos, CA 90701.

FOR SALE: Apple 216K, less than six months old, $900. Wm. A. Merlino, 120 N. Lakeside Dr., Medford, NJ 08055.

WANTED: Microdata 1600 CPU or components. Also want games for Microdata Reality. Jack Hardman, 140 Forest Ave., Glen Ridge, NJ 07028, (201) 429-8880.

FOR SALE: TRS-80 system with Level II BASIC and 16K RAM in complete and clean condition. $795 shipped UPS/COD collect. Includes personal and business software packages. FREE. In original cartons with manuals. William Byers, Newcastle, ME 04553.

FOR SALE: Micropolis Macrofloppy, factory assembled and tested, 2 months old. Includes free software and blank diskettes. First check or M.O. over $750 takes it. Contact David or Robert Mason, 503 Timber Terr., Houston, TX 77024, (713) 681-3427 after 7 p.m.

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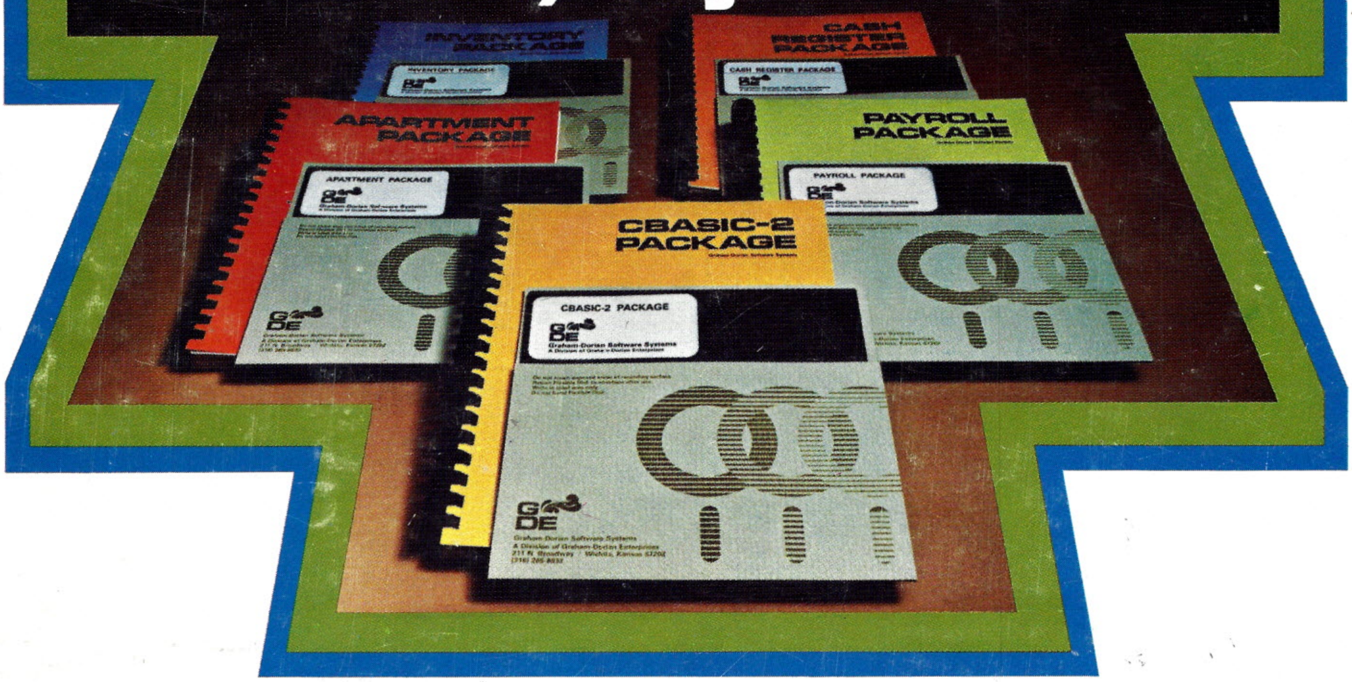
Programs you can use in your business... ready to go now!



Our programs will let you realize the full potential of your hardware.

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Here's a typical program

To give you an idea of the thoroughness of these programs, here's a summary of what the inventory package does for you. Gives a detailed listing of items in inventory and itemizes all goods sold from inventory, including which sales person sold what, when it sold and for how much ... recaps on one sheet this same inventory activity information ... investigates and changes any information in inventory, on request ... prints list of items to be re-ordered ... provides profit analysis comparing sales personnel and/or various products. And it can be inter-connected with our cash register package as well, for total program management.

Each of our initial programs is conceived, proven and offered with this same exacting thoroughness and attention to detail.

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CBASIC-2 was developed and written by Software Systems, the people who wrote CBASIC, and includes many powerful enhancements.* All systems are compatible with any Z-80 or 8080 CP/M™ system. They are deliverable in standard eight-inch disk — either double or single density — or mini-floppy disk.

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*CBASIC-2 may be purchased separately from Graham-Dorian Software Systems for $89.95.

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